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ARMS CONTROL VERIFICATION OCCASIONAL PAPERS No. 3

International Atomic Energy Agency Safeguards as a Model for Verification of a Chemical Weapons Convention

Proceedings of a Workshop held at Banff Springs Hotel, Alberta, Canada, October 21-24, 1988

Edited by H. Bruno Schiefer

Toxicology Research Centre

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and

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prepared for The Arms Control and Disarmament Division, Department of External Affairs, Ottawa, Ontario, Canada

The cover graphic is based on an ancient Egyptian hieroglyph representing the all-seeing eye of the powerful sky god, Horus. Segments of this "eye in the sky" became hieroglyphic signs for measuring fractions in ancient Egypt. Intriguingly, however, the sum of the physical segments adds up to only 63/64 and, thus, never reaches the equivalent of the whole, or perfection. Similarly, verification is unlikely to be perfect.

Today, a core element in the multilateral arms control verification process is likely to be the unintrusive "eye in the sky," or space-based remote sensing system. These space-based techniques will have to be supplemented by a package of other methods of verification such as airborne and ground-based sensors as well as some form of on-site inspection and observations. All these physical techniques add together, just as the fractions of the eye of Horus do, to form the "eye" of verification. Physical verification, however, will not necessarily be conclusive and there is likely to remain a degree of uncertainty in the process. Adequate and effective verification, therefore, will still require the additional, non-physical, element of judgement, represented by the unseen fraction of the eye of Horus.

Arms Control Verification Occasional Papers

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Preface

As negotiations on a Chemical Weapons Convention continue, it has become obvious that the areas of compliance and verification, particularly the issues of non-production and challenge inspection, touch on many sensitive spots. These areas present a major organizational and logistic challenge to the proposed Technical Secretariat and its overseeing Committees of the Chemical Weapons Convention. The International Atomic Energy Agency (IAEA) has been engaged in the verification of compliance with obligations respecting peaceful uses of nuclear materials and facilities for more than 20 years. Given this experience, it is natural to review the goals, the organizational framework of the IAEA and the varied experiences of that organization to learn as much as possible from this experience. For this purpose, a Workshop was organized by the Strategic Studies Program of the University of Calgary.

There were 19 participants from Canada, the United States and Europe. These participants included officials of the governments of Canada, the United States, the Netherlands and Sweden as well as selected academics, officials (current and retired) of the International Atomic Energy Agency and of Atomic Energy of Canada Ltd. In essence, the participants included a number of persons who had detailed, high-level expertise in the functioning of IAEA safeguards, a smaller group who were privy to the latest details of the Chemical Weapons Convention negotiations and a tiny minority who were not specialists in either area of expertise, but who were concerned with the broader view of international relations.

The Workshop and the publication of these proceedings were made possible by financial support from the Department of External Affairs. Special thanks are due Ralph Lysyshyn, Director, Arms Control and Disarmament Division, and Ron Cleminson, Head, Verification Research Unit of the same Division. Thanks go also to Harriet Critchley, who chaired the Workshop, and to her assistants at the University of Calgary, who arranged the program and took care of the facility arrangements.

These proceedings do not always reflect the actual sequence of presentations. Each session of the Workshop was followed immediately by a discussion period. However, the salient features of all discussions are summarized in the final chapter of these proceedings.

The views expressed in these proceedings are those of the authors, and do not represent the opinion of the organizations with which these individuals are associated, nor do any statements reflect the policies of the Canadian government.

H. Bruno Schiefer
James F. Keeley

Préface

À mesure que les négociations se poursuivent en vue de la conclusion d'une convention sur les armes chimiques, il devient évident que les questions de conformité et de vérification, celles de la non-production et des inspections par mise en demeure, en particulier, touchent bien des cordes sensibles qui représentent un défi organisationnel et logistique de taille pour le Secrétariat technique envisagé et ses comités de surveillance de la Convention sur les armes chimiques. L'Agence internationale de l'énergie atomique (AIEA) est chargée depuis plus de vingt ans de vérifier la conformité aux obligations relatives à l'utilisation pacifique des matières et des installations nucléaires. Il est naturel, par conséquent, qu'on s'interroge sur les objectifs et les structures organisationnelles de l'AIEA, ainsi que sur les expériences diverses de cet organisme, afin d'en tirer les meilleures leçons possible. C'est à cette fin qu'on a organisé un atelier dans le cadre du programme des études stratégiques de l'Université de Calgary.

L'atelier regroupait dix-neuf participants du Canada, des États-Unis et d'Europe. Il s'agissait de représentants des gouvernements du Canada, des États-Unis, des Pays-Bas et de la Suède, de même que d'universitaires triés sur le volet, de fonctionnaires (en service et à la retraite) de l'Agence internationale de l'énergie atomique et d'Énergie atomique du Canada Ltée. Parmi les participants, on comptait des personnes connaissant en profondeur le fonctionnement des garanties de l'AIEA, un groupe plus petit au courant des derniers détails des négociations relatives à la Convention sur les armes chimiques et une petite minorité qui n'était spécialiste de ni l'un ni l'autre de ces domaines de compétence mais qui s'intéressait de façon générale aux relations internationales.

La tenue de l'atelier et la publication du présent compte rendu ont été rendues possibles par l'aide financière accordée par le ministère des Affaires extérieures. Il convient de remercier en particulier M. Ralph Lysyshyn, directeur du Contrôle des armements et du désarmement, et M. Ron Cleminson, chef de la Section de vérification et de recherche de cette direction. Nous remercions également M^me^ Harriet Critchley qui a présidé l'atelier, et M. James Keeley de l'Université de Calgary, ainsi que leurs adjoints, qui ont pris en charge les préparatifs du programme et se sont occupés des installations.

Le présent compte rendu ne suit pas nécessairement l'ordre des exposés. Les séances étaient suivies immédiatement par une période de discussion, mais les faits saillants de tous les débats ont été résumés dans le dernier chapitre du compte rendu.

Les points de vue exprimés dans le compte rendu sont ceux de leurs auteurs et ne témoignent donc pas de l'opinion des organismes avec lesquels ces personnes sont associées, pas plus que les déclarations qu'on peut y trouver ne représentent les politiques du gouvernement du Canada.

H. Bruno Schiefer

James F. Keeley

Synopsis

Harriet Critchley
Strategic Studies Program
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The Workshop opened with some welcoming remarks by Canada's Ambassador to the United Nations and to the Conference on Disarmament, de Montigny Marchand. Ambassador Marchand, whose responsibilities include the on-going chemical weapons negotiations in the 40-member Conference on Disarmament in Geneva, outlined the aims and context for the Workshop.

The sessions of the Workshop were organized into three sequential categories of topics: current thinking in the Chemical Weapons negotiations (at the Conference on Disarmament, Geneva); the IAEA safeguards experience; and the applicability of the IAEA procedures and experience to verification of an international agreement to ban chemical weapons.

Current Thinking in the Chemical Weapons Negotiations

Jim Sheaks of the U.S. Arms Control and Disarmament Agency discussed United States views on chemical weapons. His remarks focussed on describing the "rolling text" as it pertains to areas where progress has been made in the negotiations; the three criteria set by the U.S. for an acceptable chemical weapons agreement; and the seven basic concepts within the "rolling text." He concluded by identifying two major unresolved issues related to the IAEA experience in terms of its applicability to a chemical weapons agreement — the matter of challenge inspections and the nature of the verification institution which might be created.

In the second session, Gordon Vachon of the Canadian Department of External Affairs focussed on the background to, and current content of, the more detailed negotiations on the structure of the international chemical weapons verification authority and the international inspectorate. He also identified problems that are inherent both in the relevant details of the agreement to date and in the practical implications of those agreed items.

The third session consisted of a lengthy discussion moderated by Bas ter Haar of the Netherlands Foreign Ministry. At the outset, Mr. ter Haar stressed what he thought were the two basic differences between the IAEA safeguards model and the Chemical Weapons Convention (as the latter is

shaping up in negotiations). In general, he criticized the current focus on technical and quantitative approaches to verification and advocated more discussion of political and qualitative aspects.

The IAEA Safeguards Experience

In the first session, James F. Keeley of the University of Calgary presented a summary of his paper "IAEA Safeguards. Observations on Lessons for Verifying a Chemical Weapons Convention."* Dr. Keeley highlighted the differences and the similarities between the verification regime and procedures of the IAEA and any verification regime for chemical weapons.

In the second session, David Fischer, former Assistant Director General of External Relations at the IAEA, discussed the objectives (including historical changes), structure and process of the IAEA safeguards. He stressed the role of the IAEA safeguards as a confidence-building measure, rather than a policing or deterrence measure and said that the nature of the political structure of any chemical weapons verification organization will be the most important structural problem. In addition, the individual and collective co-operation of states party to a chemical weapons agreement are essential to ensure sufficient resources and support for effective verification.

In the third session, Adolf von Baeckmann, Advisor, Director of Safeguards, highlighted certain problems within the IAEA inspectorate organization and identified potential problems for a chemical weapons inspectorate. These included the crucial role of the Deputy Director General; the desirability of having a rolling roster of experts for use in an inspectorate; the larger (and more complex) task of chemical weapons inspection; the difficulties in transporting samples around the world and of setting up analytical laboratories.

The fourth session focussed on operational considerations in the IAEA experience. Professor Lawrence Scheinman of Cornell University presented a paper which dealt with the issues of surveillance, confidentiality of information and the problems of anomalies in inspection results. He concluded with the observation that the IAEA mixes co-operative and independent (with its attendant adversarial) aspects of verification and noted the problems that chemical weapons verification might present in these areas.

In the fifth session, Benjamin Sanders, a private consultant with the Programme for Promoting Nuclear Non-Proliferation, concentrated on practical issues associated with the legal basis for verification agreements; the human (or, personnel) aspects of inspections; and the management of a verification

* Arms Control Verification Occasional Papers, No. 1 (Ottawa: Department of External Affairs, 1988).

system. He noted the experience to date with several types of verification agreements and pointed to the need for timely planning prior to the conclusion of a chemical weapons agreement.

In the sixth session, Professor Nicholas Kyriakopoulos of George Washington University discussed the nature of technological change in general, its effects on verification and the difficulties that the IAEA encountered when it incorporated technological change (such as new methods of information processing and automated inspections) into its verification procedures. He concluded with recommendations for improvement in the IAEA and for monitoring a chemical weapons agreement.

The final session in this category took a slightly different view of the IAEA. Whereas earlier papers discussed aspects of the IAEA from an international perspective, Eric Payne of Atomic Energy of Canada Ltd. (AECL), focussed on the national (that is, Canadian) infrastructure for implementing IAEA safeguards. He discussed inspections at the AECL Research Co. and at other Canadian facilities, the infrastructure for monitoring and the manpower requirements for accommodating IAEA safeguards inspections in Canada.

Applicability of IAEA Procedures and Experience

This category of topics consisted of two discussion sessions.

The first session was an extended discussion of organizational matters as they relate to a chemical weapons agreement. This session was moderated by Johan Molander of Sweden's delegation to the Conference on Disarmament, who, in his preliminary remarks, stressed the lessons from the IAEA experience in addressing the problems of: creating an effective executive council; providing for appropriate financial underpinning; and assuring adequately trained and supported personnel for the verification organization. The ensuing discussion concentrated mainly on organizational matters, especially on the problems of creating an effective executive council. Financial and confidentiality issues were also discussed.

The second session, chaired by Ron Cleminson of Canada's Department of External Affairs, focussed on avoiding mistakes in setting up an international inspectorate. Each participant was asked to identify or suggest at least one mistake (presumably made in the IAEA system) that should be avoided in a chemical weapons verification system. This approach brought out some of the central issues that were discussed during the conference.

The workshop closed with the concluding remarks by Harriet Critchley. In referring to Dr. Keeley's description of the similarities in requirements for

verification between the Chemical Weapons Convention and the IAEA safeguards, she noted that most of the discussion had focussed on areas of low similarity. She reviewed those points of low similarity, or dissimilarity, and then suggested that the collective efforts of the conference participants had produced a positive conclusion: the encouragement of creative efforts at finding institutions, processes and techniques that will meet the very real problems of chemical weapons arms control verification.

Aperçu

Harriet Critchley
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Université de Calgary, Calgary (Alberta)

L'atelier est inauguré par un exposé liminaire de l'ambassadeur du Canada auprès des Nations Unies et de la Conférence sur le désarmement, M. de Montigny Marchand. L'ambassadeur Marchand, dont les responsabilités incluent les négociations sur les armes chimiques actuellement en cours à la Conférence sur le désarmement à Genève, qui regroupe 40 membres, présente les grandes lignes des objectifs et du contexte de l'atelier.

Les séances de l'atelier sont structurées selon trois catégories de sujets présentés dans l'ordre : orientation actuelle des négociations sur les armes chimiques (à la Conférence sur le désarmement à Genève), l'expérience de l'AIEA en matière de garanties, et l'applicabilité des procédures et de l'expérience de l'AIEA à la vérification d'un accord international destiné à interdire les armes chimiques.

Orientation actuelle des négociations sur les armes chimiques

M. Jim Sheaks de l'*US Arms Control and Disarmament Agency* présente le point de vue des États-Unis sur les armes chimiques. Dans son exposé, il s'attache à décrire le texte en cours de rédaction du point de vue des domaines où des progrès ont été réalisés dans les négociations, des trois critères d'un accord acceptable sur les armes chimiques fixés par les États-Unis et des sept concepts de base que comporte le texte en cours de rédaction. En conclusion, il met en évidence les deux grandes questions non résolues se rapportant à l'expérience de l'AIEA, sur le plan de son applicabilité à l'accord sur les armes chimiques, soit la question des inspections par mise en demeure et la nature de l'institution de vérification que l'on pourrait créer.

Dans la deuxième séance, M. Gordon Vachon du ministère canadien des Affaires extérieures fait la genèse et présente le contenu actuel des négociations détaillées sur la structure de l'organe international de vérification des armes chimiques et de l'inspection internationale. Il mentionne également les problèmes inhérents à certains détails de l'accord, tel qu'il a été négocié jusqu'à présent, et aux implications pratiques des dispositions déjà convenues.

La troisième séance consiste en un débat prolongé, animé par M. Bas ter Haar du ministère des Affaires étrangères des Pays-Bas. Dès le début,

M. ter Haar explique ce qu'il considère comme les deux différences fondamentales entre le modèle des garanties de l'AIEA et la Convention sur les armes chimiques (telle que celle-ci prend forme dans les négociations). De façon générale, il désapprouve l'orientation actuelle qui privilégie les approches techniques et quantitatives de la vérification et se montre en faveur de plus amples discussions sur les aspects politiques et qualitatifs.

L'expérience de l'AIEA en matière de garanties

Au cours de la première séance, M. James F. Keeley de l'Université de Calgary, présente un résumé des conclusions de son ouvrage intitulé *Garanties de l'AIEA : Observations sur les leçons applicables à la vérification découlant d'une convention sur les armes chimiques**. M. Keeley souligne les différences et les similitudes entre le régime et les procédures de vérification de l'AIEA et le régime de vérification des armes chimiques que l'on pourrait envisager.

Pendant la deuxième séance, M. David Fischer, ancien directeur général adjoint des Relations extérieures de l'AIEA, analyse les objectifs (y compris leurs modifications historiques) et le fonctionnement des garanties de l'AIEA. Les points à retenir sont les suivants : le rôle des garanties de l'AIEA est davantage de créer un climat de confiance que de servir d'instrument de contrôle ou de dissuasion; la nature de la structure politique de l'organisme de vérification des armes chimiques représentera le problème structurel le plus important; la collaboration, individuelle et collective, des États parties à l'accord sur les armes chimiques est essentielle si l'on veut obtenir suffisamment de ressources et de soutien pour assurer une vérification efficace.

Au cours de la troisième séance, M. Adolf von Baeckmann, conseiller, directeur des Garanties, met en évidence certains problèmes auxquels se heurte l'organisme d'inspection de l'AIEA et signale les difficultés possibles auxquelles aurait à faire face l'inspection des armes chimiques envisagée. Les facteurs clés sont les suivants : le rôle critique du directeur général adjoint; les avantages que présenteraient des équipes d'experts fonctionnant par roulement à l'inspection; le mandat plus vaste (et plus complexe) de l'inspection des armes chimiques; les difficultés que présente le transport des échantillons dans le monde entier et la mise en place de laboratoires d'analyse.

La quatrième séance porte sur des aspects opérationnels de l'expérience de l'AIEA. Le professeur Lawrence Scheinman de l'Université Cornell présente un article sur la surveillance, sur le caractère confidentiel de l'information et sur le problème des anomalies dans les résultats d'inspection. En conclusion, il fait

*Études ponctuelles sur la vérification du contrôle des armements, nº 1 (Ottawa, ministère des Affaires extérieures, 1988).

observer que l'AIEA oscille entre la vérification en collaboration et la vérification indépendante (qui suppose une certaine opposition) et mentionne les problèmes que pourrait poser à cet égard la vérification des armes chimiques.

Au cours de la cinquième séance, M. Benjamin Sanders, expert-conseil auprès du Programme pour la non-prolifération des armes nucléaires, fait porter l'attention sur des problèmes pratiques liés au fondement juridique des ententes de vérification, aux aspects humains de la conduite des inspections (c.-à-d. intéressant le personnel) et à la gestion du système de vérification. Il signale l'expérience faite jusqu'à présent de plusieurs types d'ententes de vérification et souligne la nécessité d'une planification réalisée en temps opportun avant la conclusion d'un accord sur les armes chimiques.

Pendant la sixième séance, le professeur Nicholas Kyriakopoulos de l'Université George Washington examine la nature des changements technologiques en général, leurs effets sur la vérification et les difficultés qu'a connues l'AIEA pour les intégrer à ses procédures de vérification (notamment les nouvelles méthodes de traitement de l'information et les inspections automatisées). Il termine par des recommandations visant à améliorer l'AIEA et à surveiller l'éventuel accord sur les armes chimiques.

À l'occasion de la dernière séance de cette catégorie, on présente un point de vue légèrement différent sur l'AIEA. Alors que tous les autres exposés portaient sur divers aspects de l'AIEA dans une optique internationale, M. Eric Payne d'Énergie atomique du Canada Ltée (EACL) s'intéresse avant tout à l'infrastructure nationale (canadienne, en l'occurrence) de mise en œuvre des garanties de l'AIEA. Il examine les inspections réalisées à la Société de recherche d'Énergie atomique du Canada et dans d'autres installations canadiennes, l'infrastructure de surveillance et les besoins en main-d'œuvre pour effectuer les inspections relatives aux garanties de l'AIEA au Canada.

L'applicabilité des procédures et l'expérience de l'AIEA

Cette catégorie de sujets donne lieu à deux séances de discussion.

La première séance fait suite aux débats sur les questions organisationnelles se rapportant à l'éventuel accord sur les armes chimiques. Cette séance est animée par M. Johan Molander de la délégation suédoise à la Conférence sur les armements qui, dans son exposé liminaire, insiste sur les enseignements que l'on peut tirer de l'expérience de l'AIEA pour s'attaquer aux problèmes suivants : création d'un conseil exécutif efficace; mise en place d'assises financières

convenables; obtention d'un personnel suffisamment formé jouissant des appuis nécessaires pour l'organisme de vérification. La discussion qui suit porte surtout sur des questions d'organisation, en particulier sur les problèmes que pose la création d'un conseil exécutif efficace. On discute également de questions financières et du caractère confidentiel de l'information.

La deuxième séance, présidée par M. Ron Cleminson du ministère des Affaires extérieures du Canada, met l'accent sur les erreurs à éviter dans la constitution d'une inspection internationale. Chacun des participants est invité à préciser ou à signaler au moins une erreur (vraisemblablement commise dans le système de l'AIEA) qu'il conviendrait d'éviter dans le cadre du système de vérification des armes chimiques. Cette façon de procéder permet de mettre en évidence les questions clés discutées au cours de la conférence.

Il est mis fin officiellement à l'atelier par un discours de clôture prononcé par M^me^ Harriet Critchley. En référence à l'exposé de M. Keeley sur les similitudes dans les exigences de vérification entre la Convention sur les armes chimiques et les garanties de l'AIEA, elle fait observer que la plupart des discussions ont surtout souligné les aspects de faible similitude. Elle passe en revue ces divers aspects, c'est-à-dire les différences fondamentales, et affirme que les efforts collectifs des participants à la conférence ont abouti à un résultat positif, celui d'encourager la créativité pour définir les institutions, les processus et les techniques susceptibles de résoudre les problèmes réels que pose la vérification du contrôle des armes chimiques.

List of Abbreviations and Acronyms

AECB	Atomic Energy Control Board of Canada
AECL	Atomic Energy of Canada Limited
CANDU	Canadian Deuterium Uranium Reactor
CBM	Confidence-Building Measures
CC/GC	Consultative Committee/General Conference
CCD	Charge-Coupled Devices
CCTV	Closed-Circuit Television
CD	Conference on Disarmament
CD/500	Draft Convention on the Prohibition of Chemical Weapons, tabled by the U.S. at the Conference on Disarmament, 18 April 1984
COSMOS	Compact Surveillance Monitoring System
CRNL	Chalk River National Laboratories
CVD	Cerenkov Viewing Device
CW	Chemical Weapon(s)
CWC	Chemical Weapons Convention
EURATOM	European Atomic Energy Community
FFP	Fact-Finding Panel
FRG	Federal Republic of Germany
IAEA	International Atomic Energy Agency
INF	Intermediate Nuclear Forces
INFCIRC	Information Circular

IWG-RPS	International Working Group on Reprocessing Plant Safeguards
JAERI	Japan Atomic Energy Research Institute
LWR	Light Water Reactor
MBA	Material Balance Area
MIVS	Modular Integrated Video System
NDA	Non-Destructive Assay
NNA	Neutral and Non-Aligned
NNWS	Non-Nuclear Weapons States
NPT	Non-Proliferation Treaty
NWS	Nuclear Weapon States
OECD	Organization for Economic Co-operation and Development
OPWC	Organization for the Prohibition of Chemical Weapons
PIV	Physical Inventory Verification
R&D	Research and Development
RECOVER	Remote Continuous Verification (System)
"Rolling Text"	Draft Convention on Chemical Weapons currently under negotiation at the Conference on Disarmament
SAC	Scientific Advisory Council
SAGSI	Standing Advisory Group on Safeguards Implementation
SAL	Safeguards Analytical Laboratory
SIM-PIV	Simultaneous Physical Inventory Verification
SIPRI	Stockholm International Peace Research Institute

SSAC	State System of Accounting and Control
STAR	Surveillance Television and Recording System
START	Strategic Arms Reduction Talks
TASTEX	Tokai Advanced Safeguards Technology Exercise
UF6	Uranium Hexafluoride
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WNRE	Whiteshell Nuclear Research Establishment

Chapter 1. Welcoming Remarks

de Montigny Marchand
Permanent Canadian Representative, Ambassador to the United Nations and to the Conference on Disarmament, Geneva

It gives me great pleasure, on behalf of the Department of External Affairs, to welcome you all to this wonderful part of Canada. Although I know that Harriet Critchley and her staff of the University of Calgary, in conjunction with the staff of the Verification Research Unit, have put together a very intense work schedule, I trust you will still have an opportunity to benefit from the great outdoors. Perhaps we can all take some inspiration from our surroundings as we contemplate matters related to peace and security.

To this gathering we all bring experience in public service, in organizational matters and in international affairs. It is fortunate, given the informal nature of much of the work to follow, that there is no need for me to dwell upon the reputations and accomplishments of our foreign guests — fortunate because that alone would have taken up all of the time available to me. It is worth mentioning one obvious point, however: we have not been brought together because we are all experts on the chemical weapons negotiations. While we certainly have among us a number of participants who can lay claim to such status, others are particularly knowledgeable about the International Atomic Energy Agency — the IAEA — and, more specifically, about the details of setting up and operating its Safeguards system. So, the purpose of this exercise is to engage in what may loosely be characterized as a little "lateral thinking". One writer has said that:

> *Vertical thinking is digging the same hole deeper; lateral thinking is trying again elsewhere.*

Our common task is to consider what lessons might be derived from the IAEA experience which could then be applied in an entirely different context, that of a future chemical weapons convention. Everyone here is knowledgeable about one or more aspects of the central theme of this workshop, and its organizers have striven to provide a logical framework for the distillation of many combined years of experience into perhaps a few salient lessons.

I mentioned a "logical framework" — in fact, logic has a lot to do with this exercise if we accept the view that:

> *The purpose of logic should not be so much to find the final conclusion, but to make sure that it is sound once it has been found.*

Our governments have already decided upon the final conclusion: to rid the world of chemical weapons through a global, comprehensive and verifiable convention. At the sharp end of the negotiations from whence I come, our task is to ensure *to the extent possible* that the legal document, and the organization responsible for monitoring compliance with the obligations of that document, give proper expression to the high ideals and demanding objectives that have been set. As we approach the twentieth year of addressing the issue in increasing degrees of detail and complexity, it is certainly an understatement to say that the task is not an easy one. Furthermore, there have been and still are few beacons upon which we can take bearings in negotiating these waters.

CW negotiators have already looked to the IAEA for models of subsidiary agreements which, under the overall convention, would then provide the basis for separate negotiations with each State Party in establishing the detailed framework for inspections of specific chemical facilities. Guidance has been provided on other matters as well, including:

- the privileges and immunities of inspectors;
- general rules governing inspections and the conduct of inspectors;
- provisions for the employment and emplacement of monitoring equipment on-site; and
- provisions for the secure storage on-site of instruments and documentation.

These certainly are all important matters and they indicate the level of detail at which much time is now spent. In fact, the negotiations jump back and forth from one level to another, which has provoked the comment in some quarters that many of the details can be worked out by a preparatory commission, after the agreement has been tabled and, possibly, even after being opened for signature. Perhaps I can play the devil's advocate in saying that this debate will intensify in the next year and take on the character of principle vs pragmatics. In some quarters, it is sometimes suggested, there is an almost theological belief that all details must be nailed down, even though we all recognize that various procedures, and perhaps even the convention itself, will need to be revised in the light of experience and technological developments. It is, after all, supposed to be a convention of unlimited duration. Whatever your point of view, this is an evolving debate, which I hope we will all bear in mind as we consider many of the practical organizational, operational and administrative matters which may apply to the body that will be established,

. . . to achieve the objectives of the Convention, to ensure the implementation of its provisions, including those for international verification of compliance with it, and to provide a forum for consultation and co-operation among States Parties.

We in Canada, through the Verification Research Programme, have tried to examine in detail some of the key issues with a view to expediting the negotiations. For example, we have provided to the Conference on Disarmament work we have done on procedures for the verification of allegations of the use of chemical weapons and, together with Norway, have put forward a proposal on this subject which gives other participants something "to shoot at" during the negotiations.

We have also been very interested in the machinery that will be created to implement the convention. Knowing that Dr. Keeley of the University of Calgary had a particular interest in the operation of the IAEA, we agreed to assist him in his efforts and, in return, we asked him to direct some of his energy to considering whatever lessons — both positive and negative — might apply in other arms control contexts. Some two years of co-operation have produced a commendable document of which you have received copies, and, at the same time provided the impetus for this conference.

Also assisting us on these issues have been staff from the University of Saskatchewan. One such study in which Bruno Schiefer (present with us) and Ron Sutherland (not present) took part involved an analysis of the skills and personnel which would be needed by an inspectorate in order to perform its role in monitoring compliance with the obligations of the convention. A rather compressed version of some of the material from that systems study has been distributed to you in the form of a presentation that Dr. Sutherland has delivered in various forums. I should add that Dr. Sutherland is not present with us because he is following up the earlier "qualitative" study with an attempt to put together a "quantitative" model which will highlight personnel and financial resource implications of setting up the Inspectorate. As you will appreciate, this is not an easy task in that there are so many unknowns, particularly about the size and nature of the civilian chemical industry that will be subject to data reporting, routine inspections — and now possibly a new variant, "ad hoc checks" — quite apart from any challenge inspection requirements. Although Dr. Sutherland is absent, there are others here present who are either involved in the same study, or involved in similar work in other countries, and they will certainly have much to contribute to our discussions. I trust they will also benefit from our collective insights.

Perhaps enough has been said for the time being in setting the scene for the remainder of our time together as we consider "IAEA Safeguards as a Model for Verification of a Chemical Weapons Convention." The topics of the

presentations look fascinating, and I am certain the ensuing discussion will be equally fascinating. I believe this work is very timely indeed and, if anything, should remind us that valid research is not produced overnight. Considerable lead-times are involved, which require both foresight and imagination on the part of those responsible for the research program. It also requires dedication on the part of the researcher; and I am told that, in the case of Dr. Keeley, such dedication was very much in evidence.

My final words are directed to the workshop organizers both at the University of Calgary and the Department of External Affairs, in saying that I very much look forward to what promises to be an intense and interesting few days.

Chapter 2. Current Thinking in the Chemical Weapons Convention

2.1. Overview and Objectives of a Chemical Weapons Convention

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It is my task to provide a few personal thoughts on the negotiations on a CW Convention (CWC): where they've come in recent years, where they stand and where they may be headed in the next couple of years. These views do not represent U.S. government policy, although I believe they are more or less consistent with the themes expressed by U.S. government representatives in Geneva.

The U.S. is one of several countries which are major contributors to the development of a CWC. CD/500, tabled by Vice President Bush in 1984, forms the basis for the "rolling text" in the negotiations and for U.S. policy towards the CWC. Since 1984, the U.S. and Soviet Union have engaged in ten rounds of intensive bilateral discussions aimed at resolving differences to move a Convention forward. We have had several successes: we have agreed to a joint approach for the destruction of CW production facilities and have developed an outline of a bilateral agreement for data exchange which includes a challenge inspection provision to validate the data on stockpiles and production facilities. This bilateral agreement would enter into force prior to the CWC and would be a necessary confidence building measure as a prelude to implementation of the CWC.

The U.S. approach to the CWC is based on assuring two primary objectives: increased security for the U.S. and the Alliance; and halting the spread of CW technology and use. To accomplish these objectives the CWC must comprise a comprehensive ban on production, storage, use, acquisition, transfer and research and development of CW materials and technology. In addition, all CW capable states must become parties, and the CWC must be "effectively verifiable." (I have used quotes to imply that "effective verification" is a highly complex, subjective issue that combines a myriad of technological and political factors, difficult to quantify and perhaps changing with time and the world political climate.)

While a good bit of progress in filling in the rolling text has been made, a number of problems remain. Two distinct but integrally related areas,

verification and institutional, are perhaps the two most formidable challenges. I will focus my remarks on the verification issues. Additional issues include how to set up national systems for implementing and harmonizing data reporting and export controls, providing assistance for humanitarian and defensive purposes, and North-South technology transfer.

CWC verification has two operationally distinct regimes: routine monitoring of declared facilities/data, and challenge inspection provisions for suspect non-declared production. In designing procedures and personnel to operate these two regimes, the institutional aspects of decision-making, costs and resource allocation will be dominate factors. The large number of civilian industry facilities which are *capable* of producing CW materials will dictate against routine monitoring of each and every facility. Furthermore, the large throughputs of materials of plants producing key precursors of CW materials and the associated large uncertainties will make it difficult, if not impossible, to "close" the material balance. These considerations dictate that a system of unannounced inspections, e.g., ad hoc checks or routine challenge inspections, will play a central role in monitoring the civilian industry. This is in contrast to the IAEA system which is based on materials accountancy.

On challenge inspection, a couple of key issues must be resolved. Of primary importance will be protection of sensitive national security information during a challenge inspection. Because of the nature of CW production (relatively small equipment), the difficulties in protecting sensitive information exceed those of INF and START. Further, the procedures for a challenge inspection must both satisfy the concerns of the challenging state and protect the challenged state from frivolous challenges and provide both parties assurance of a thorough, competent investigation. Obviously, this is a high priority topic on the U.S./U.S.S.R bilateral agenda. Even though both sides have agreed to the principal of "anytime, anywhere challenge inspection," the details of how to implement challenge inspection in view of the above considerations have yet to be agreed. Close attention to the INF provisions and the developments in START may provide an indication of some of the key elements relevant to a CWC.

On the prospects for the future, I would note that both U.S. presidential candidates strongly support a CW Convention. Thus it is anticipated that there will be continued and renewed energy directed at working out the verification/ monitoring provisions, addressing the diplomatic effort to bring all CW capable states into the CWC, and resolving each of the other issues relevant to the CWC.

With the wealth of experience in setting up international institutions, including that of the IAEA, the technical/institutional details could be finalized within two to three years of a political decision to proceed with a CWC. However, as with any arms control negotiation, prospects for success will depend ultimately on the political will of each of the parties involved.

2.2. Structure of the International Authority and an International Inspectorate to Monitor Compliance

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We think in generalities, we live in detail
Alfred North Whitehead

Introduction

The conference organizers, with a view to economy, have actually built two topics into this one presentation. First, there is a need to discuss the Organization for the Prohibition of Chemical Weapons as a whole, and the relationship of its integral parts. Then it is necessary to focus on a major element of one of those parts, the International Inspectorate. Thus, here as in the negotiations, our discussion will move from a "macro" level of detail to the "micro" level. To assist in focussing attention on these organizational issues, four Tables have been prepared which are derived from and highlight appropriate elements of the "rolling text" (CD/874, 12 September 1988).

Principal Organs of The Organization

Table 1 provides a schematic diagram of the three principal organs of the Organization for the Prohibition of Chemical Weapons (OPCW). It is not an "organization chart" in any sense in that it neither portrays levels of authority nor lines of communication.

Nevertheless, the schematic diagram:

- distinguishes between the diplomatic representation of States Parties on the one hand and the staff on the other;
- distinguishes between the executive function on the one hand and the operational function on the other;
- demonstrates that the Executive Council will be chosen from the Consultative Committee/General Conference (CC/GC), and that the International Inspectorate will be part of the Technical Secretariat.

Table 1

Organization for the Prohibition of Chemical Weapons (OPCW)

Objectives

- **to achieve the objectives of the Convention,**
- **to ensure the implementation of its provisions, including those for international verification of compliance with it, and**
- **to provide a forum for consultation and co-operation among States Parties.**

Organs **OPCW**

Chairperson
CONSULTATIVE COMMITTEE (CC)
or
GENERAL CONFERENCE (GC)

Director General
TECHNICAL SECRETARIAT

Executive Council

International Inspectorate

Subsidiary Organs Under Discussion

- Scientific Advisory Council
- Fact-Finding Panel

Then matters begin to get fuzzy. For example, we *know* that the Director General of the Technical Secretariat will be responsible to the CC/GC and to the Executive Council. We *assume* that this will be through a single Chairperson presiding over both the CC/GC and the Executive Council. However, one viewpoint has the Chairperson being elected in the CC/GC and also presiding as a non-voting Chairperson of the Executive Council; and another viewpoint has the Executive Council electing its Chairperson who then, presumably, would also become Chairperson of the CC/GC. Let us hope that we are spared the "compromise" solution of each body electing its own Chairperson, with the Director General reporting to both. There is another possible solution, not much more attractive than the last one, which is that the

Chairperson of the CC/GC would only be elected and preside during a regular or special session of that body. However, the question then arises as to the effective performance of the executive function when the CC/GC is in session, especially if it were in session for a protracted period of time. To whom does the Director General report?

This raises another question: Does the Executive Council continue to function when the CC/GC is in session, or does the "parent" body then assume those functions? Thinking on this question is split. At issue here, to take a phrase from Ambassador Marchand's opening remarks, is a question which is being portrayed as one of "principle vs pragmatics," i.e., the overall authority of the CC/GC vs the efficient operation of the Organization and, particularly, the effective performance of the Organization's duties while the CC/GC is in session.

Both of these organizational matters have been "on the table" for some time now, although it has been convenient to set them aside and to get on with other things. However, I would venture the view that such matters will take on much greater importance in the next year or so, and I would suggest that there is ample room for polarization of the discussion on each issue. I suspect that everyone here would agree that the Director General must have a clear and single line of communications, and that the executive function must be able to be carried out in a timely fashion under all circumstances.

Continuing on the subject of the Executive Council, you will have noted that its composition is still very much a subject for negotiation. The total number of members proposed in the various formulae runs from 15 to 30. It is generally accepted that due regard should be given to "ensuring an appropriate geographic balance" (on the UN model). To this common criterion, others have been proposed, for example:

- the U.S. has proposed that five positions be allotted to the permanent members of the Security Council, and that the Executive Council total 15 members (CD/500, April 1984);
- the U.K. has proposed that a number of seats be allocated to those States Parties with the largest industrial chemical base, on the basis of criteria (e.g., output, number of declared plants, investment) to be established by the Director General it seems. This model of the Executive Council would grow to 30 members (CD/589, April 1985); and
- the G.D.R. has proposed that political, geographical and industrial considerations be taken into account, with the final composition to be 10 NNA, five Western and five Eastern countries plus China, for a total of 21 members (CD/812, March 1988).

Since my topic deals with the structure of the Organization, this paper shall confine itself to debate on the possible role of the Executive Council in "triggering" challenge inspections; and to the debate on its possible post-inspection activities, particularly in the event that an inspection team submits a "factual" report suggestive of non-compliance. These are important issues, however, and we may wish to pursue them at some stage of the discussion period. You will notice in Tables 2 and 3 that any mention of "compliance" has been highlighted with an asterisk.

Table 2

Consultative Committee/ General Conference

Organizational Aspects

- [principal] [supreme] organ of the Organization for the Prohibition of Chemical Weapons
- composed of all States Parties
- elects its Chairperson
  (who may also be non-voting Chairperson of the Executive Council — bracketted text in "rolling text")
- meets in regular annual sessions unless it decides otherwise
- meets in special sessions as it may decide

Powers and Functions

- considers any matters within the scope of the Convention, including the powers and functions of the Executive Council and Technical Secretariat
- recommends and decides on any matters raised by a State Party or brought to its attention by the Executive Council
- oversees implementation of the Convention
- promotes and [assesses] reviews compliance*
- oversees the activities of, and may issue guidelines to, the Executive Council and the Technical Secretariat
- elects the members of the Executive Council
- appoints the Director General of the Technical Secretariat
- considers and adopts the program and budget of the Organization

Table 2 continued

- reviews scientific and technological developments which could affect the operation of the Convention

Other Functions Under Discussion

- in relation to Assistance (Article X)
- in relation to Economic and Technological Development (Article XI)
- in relation to action to be taken in the event of non-compliance*

*Where it has been indicated that the organ has a role to play in relation to compliance, this has been highlighted with an asterisk.

Table 3

Executive Council

Organizational Aspects

- composition, procedure and decision-making remain to be elaborated
- the Chairperson of the CC/GC may also be the non-voting Chairperson of the Executive Council (bracketted text of "rolling text"), or may be elected by the Executive Council.

Powers and Functions

- carries out the daily executive functions of the Organization
- promotes the effective implementation of, and compliance with, the Convention
- supervises the activities of the Technical Secretariat
- co-operates with national authorities of States Parties and facilitates consultation and co-operation among States Parties at their request
- considers any matter affecting the Convention, including concerns regarding compliance*, and, as appropriate, informs States Parties and brings the matter to the attention of the CC/GC

(continued)

*Where it has been indicated that the organ has a role to play in relation to compliance, this has been highlighted with an asterisk.

Table 3 continued

- concludes agreements with States and international organizations on behalf of the Organization, subject to approval of the CC/GC
- approves agreements relating to the implementation of verification activities, negotiated by the Director General of the Technical Secretariat with States Parties
- considers and submits to the CC/GC the draft program and budget of the Organization

The last principal organ to be discussed is the Technical Secretariat (see Table 4). At least there is agreement that one should be established, and some CD members have already offered to accommodate the Organization's headquarters.

The Technical Secretariat shall comprise a Director General . . . and inspectors and such scientific, technical and other personnel as may be required.

Table 4

Technical Secretariat

Organizational Aspects

- Director General, appointed by the CC/GC upon the recommendation of . . . will be the head and chief administrative officer of the Technical Secretariat and will be responsible to the CC/GC and the Executive Council
- The International Inspectorate shall be a unit of the Technical Secretariat

Powers and Functions

- carries out the daily operational and administrative functions of the Organization
- addresses and receives communications to and from States Parties pertaining to implementation of the Convention
- negotiates the subsidiary agreements with States Parties relating to systematic international on-site verification for approval by the Executive Council
- executes international verification measures

Table 4 continued

- informs the Executive Council of any problems which have arisen with regard to the execution of its functions and of [doubts, ambiguities or uncertainties about compliance with the Convention]
- provides technical assistance and technical evaluation to States Parties
- prepares and submits to the Executive Council the draft program and budget of the Organization
- provides administrative and technical support to the CC/GC, the Executive Council and other subsidiary bodies

Other Powers and Functions Under Discussion

- in relation to requesting or initiating inspections (and ad hoc checks)

Other than that, we are very short on details. We know that the International Inspectorate will be a part of the Technical Secretariat, and there will be more to say on that in a few moments. The scientific and technical infrastructure is largely unexplored. For example, it is not clear yet whether the Technical Secretariat will have its own laboratory to analyze samples collected by its inspectors; nor is it clear as to the role the Technical Secretariat will play in developing and maintaining equipment that inspectors will need or which may be used for remote monitoring with on-site instruments.

Subsidiary Organs

The "rolling text" now attributes to the CC/GC the reasonable power "to establish such subsidiary organs as it finds necessary for the exercise of its functions in accordance with this Convention." Two such subsidiary organs have been proposed and are reflected in the "rolling text": a Fact-Finding Panel, and a Scientific Advisory Council.

Fact-Finding Panel. In its draft convention on the prohibition of chemical weapons (CD/500, 18 April 1984), the U.S. proposed that a Fact-Finding Panel (FFP) be established by the CC/GC which would be subordinate to the Executive Council and which would be responsible for:

- conducting fact-finding inquiries in relation to consultation and co-operation provisions in resolving compliance issues;

- considering requests for, initiating (and, indirectly, conducting) special on-site inspections pursuant to Article X of the U.S. draft convention, the "open-invitation" provision which is often erroneously described as an "anywhere-anytime" challenge inspection provision; considering reports on special on-site inspections; and transmitting to the Chairperson of the Executive Council its findings of fact;

- considering requests for and overseeing ad hoc on-site inspections pursuant to Article XI of the U.S. draft convention (what may loosely be described as "the other part" of challenge inspection);

- considering reports on ad hoc on-site inspections; and

- transmitting to the Chairperson of the Executive Council its findings of fact.

The American proposal for a Fact-Finding Panel is still on the table. It would be fair to say that it is not very well understood. This is further complicated by the fact that the two approaches to challenge inspection — the special on-site inspection provision (U.S. Article X) and the ad hoc on-site inspection provision (U.S. Article XI) — are also not very well understood.

It would also be fair to say that there are some concerns about the American proposal, in that:

- the U.S. and the U.S.S.R. would each have a *permanent* representative on the FFP, with another three representatives being elected and coming (one each) from the Western, Eastern and Neutral/Non-Aligned groups;

- inspectors on strength with the Technical Secretariat, but coming from each member state of the FFP, would constitute the inspection team under Article X (and, presumably, under Article XI, although the text is less clear in the latter instance).

It would not be appropriate for this presentation to attempt to portray the various positions in the debate. It is simply worth noting that the issue of equality of States Parties under the Convention has already resulted in adding a fair amount of emotional content to the debate.

Scientific Advisory Council. France has proposed the creation of a Scientific Advisory Council (SAC) which would perform a solely consultative role with its purpose being, *inter alia*, to draw the attention of the CC/GC to new products or technologies warranting monitoring and to propose

suitable verification measures and procedures (CD/747, 23 March 1987). This subsidiary organ would comprise independent personages chosen for their scientific knowledge, selection being made on an equitable geographic basis.

Some present will see a parallel to the Standing Advisory Group on Safeguards Implementation (SAGSI) of the IAEA, although the French proposal did not itself make such a connection. It would be fair to say that reaction to the proposal has been mixed.

The International Inspectorate

You will have received in the conference documentation a paper on "The Role of National and International Organizations in Verification." This is a variant of CD/823 which Canada submitted to the CD in March 1988 and which was entitled "Factors Involved in Determining Verification Inspectorate Personnel and Resource Requirements."

The task of the International Inspectorate will be to "execute international verification measures provided for in the Convention." In other words, compliance is its chief preoccupation.

It has already been mentioned that the Director General has a key role to play in the effective operation of the Technical Secretariat, and that he/she should have clear terms of reference; and, it has already been suggested that more work needs to be done on this part of the "rolling text."

> *The Director General shall be responsible to the [Consultative Committee] [General Conference] and the Executive Council for the appointment of the staff and the organization and functioning of the Technical Secretariat.*

In selecting and employing staff, and in determining the conditions of service, the paramount consideration shall be the necessity of securing the highest standards of efficiency, competence and integrity. Such is the ideal to which is added an additional consideration of due regard for recruiting staff on as wide a geographic basis as is possible. The "rolling text" goes on to say that:

> *Recruitment shall be guided by the principle that the staff shall be kept to a minimum necessary for the proper execution of its responsibilities.*

This undoubtedly all sounds familiar to participants knowledgeable about the IAEA. Also familiar will be language in the "rolling text" which would enable the Director General to establish (and seek acceptance of States Parties for) "a list of experts who may be called upon to complement

the Inspectors ... for those types of inspection which require highly specialized skills."

Since the inspection responsibilities of the International Inspectorate are still in a state of flux in the negotiations, it is not surprising that one proposes a quantitative model at his peril, given the many assumptions to be made. The Netherlands made such an attempt in 1984 (CD/445, March 1984), but I know that they agree that many of their assumptions have since been overtaken by the negotiations and that their personnel and cost conclusions seriously underestimate what the "rolling text" would now require.

Canada too is trying to move from its qualitative study to a quantitative model. We have had some lively discussions within the Western Group, and right now we are pursuing some of the work with colleagues in Finland, Sweden, Norway, and the Netherlands, as we have done with the U.K. and the U.S. Again, we hope to give other negotiators something at which to shoot, and we are convinced that the quality of the product will be that much better as a result of the presentations at this conference and the ensuing discussion.

Chapter 3. Overview of the Issues at Hand

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Introduction

The International Atomic Energy Agency's safeguards programs (see Figure 1) are perhaps the premier example of intrusive safeguarding of commercially and politically sensitive industrial processes by an international agency, so it is understandable that the IAEA and its systems should be considered as possible models for a chemical weapons verification organization. Allowing for specific differences, there are at least general parallels in such areas as the monitoring of production facilities; and even where there is a relatively low degree of correspondence, the IAEA's systems may still shed some light on problems that might be faced, for example in the area of challenge inspections.

Two Basic Considerations

If it seems reasonable to look at the IAEA as a possible model for a chemical weapons verification organization, it also seems useful to keep two basic considerations in mind.

The first consideration is that the IAEA model should not be seen as a template, to be rigidly and mechanically applied in this different area. Instead, it is a case that can be exploited to suggest possibilities and problems, responses that work and responses that fail. We can reasonably look at the IAEA's tasks, approaches, problems, strengths and weaknesses as a verification agency, and try to account for these. We can also ask whether, where, how and to what degree an agency in another area might face similar or different problems. If it is important to understand how a chemical weapons verification agency could face questions similar to those that face the IAEA's safeguards systems, it is equally important to understand how this agency might face different problems — to know the limits as well as the possibilities of applying IAEA's experience.

The second is that, although the IAEA's complex and technically sophisticated safeguards systems are an obvious and proper focus for a study, there is much more to be learned from the Agency than simply the scientific and technical aspects of safeguards. The IAEA is also relevant as an organization with certain assigned tasks, that must be designed and managed, that must

have various capacities and cope with certain limitations — financial, personnel and legal — and that must deal effectively with both internal political questions and a relationship with a political environment. We must consider these aspects of the Agency as they affect its safeguards activities, as well as its more scientific-technical aspects. The Agency's ability to function effectively in technical terms is dependent in significant part on its ability to function in these other terms.

Issues of Relevance

With so much ground to cover, this presentation is an overview[1] rather than an exhaustive examination: it indicates some broad areas of possible relevance from the perspective noted, and often simply suggests some areas where further, more detailed work might be useful. Noting a few main points, we can discern three overlapping aspects:

- safeguards relatively narrowly considered;
- organizational, legal, financial and personnel issues; and
- some broad political issues.

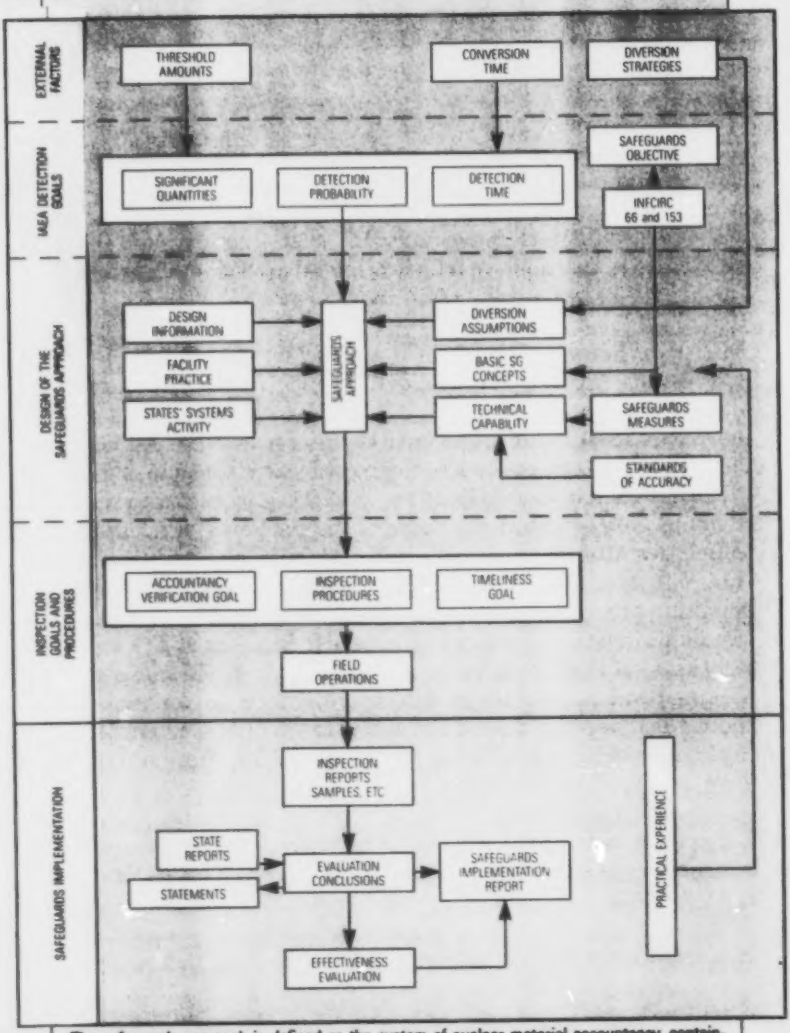
Some of these are relevant to the conceptualization, design and initial creation of a verification organization; others concern its evolution or issues that might be left for a verification agency, once created, to work out.

Mandate, Tasks, Implementation

Turning to safeguards, the IAEA experience points to a number of issues, among which are the following:

- One problem is: What precisely is the Agency supposed to do, and how? Is the problem identified as simply the misuse of a capability, more or less an "end-use" approach, or is it the existence and possible spread of certain capabilities which could be misused — a "latent proliferation" approach? IAEA safeguards are oriented to the former definition rather than to the latter, and the latter is more far-reaching in its effects and its requirements than the former. Disagreements over the merits and acceptability of these two basic approaches have been a source of strain in nuclear non-proliferation, and could also arise in a chemical weapons regime.
- Another issue is the content and scope of the Agency's mandate as compared to the obligations of states. The IAEA is limited in its

Figure 1 The Safeguards Approach



The safeguards approach is defined as the system of nuclear material accountancy, containment, surveillance and other measures chosen for implementation of safeguards in a given situation; the system is developed to satisfy the safeguards objectives of that situation. In designing the system, a model safeguards approach is developed for each type of nuclear facility; this is the adapted to specific facilities for implementation. The general scheme followed in designing a safeguards approach is illustrated in the diagram.

Source: **IAEA Safeguards Glossary, 1980, IAEA/SG/INF/1, pp. 18-19**

mandate to safeguarding declared materials and activities. The challenge inspection and other aspects of a chemical weapons agreement could build to some degree on the IAEA inspection experience, but would go beyond it. The specific techniques used by a verification agency are related to its mandate. If a chemical weapons verification scheme is largely restricted to industrial systems, whether for production or destruction, the IAEA's experience with materials accounting, containment and surveillance, and its use of systems analysis and other methods becomes relevant. If there are other activities — e.g., military activities — that could be subject to inspection, other techniques must be called into play, and the IAEA experience is less directly relevant. Investigations of allegations of use would also go beyond the IAEA experience.

- The IAEA, having been assigned a broad set of tasks in safeguarding, must reduce these to technical and operational terms and develop a system to implement these. In this process, there may be some movement from the initial objectives, insofar as these are not immediately attainable by the technical means available or permitted. We might be able to anticipate some of these problems in the chemical weapons area by examining some of the problems, (e.g., in statistical techniques, data requirements and availability, the problems of national control systems, the ability to close materials balance areas, the particular problems posed by facilities with large through-puts or handling continuous streams of materials, and the ability to handle technological change) in both safeguards techniques and approaches on the one hand and the target industry and activities on the other. We should also note the time it has taken for the IAEA to develop and deploy its safeguards over the nuclear fuel cycle. Time is a factor that must be taken into account.

- The specific place and functions of inspections in the broader safeguards systems are worth mentioning. The Agency's distinctions among ad hoc, routine and special inspections, and the possible relevance of its special and surprise inspections to the problem of challenge inspection, should be noted here.

- What legal capabilities are needed for the appropriate discharge of the Agency's mandate? For the IAEA, these include not only questions of design review, but also issues of the legal rights and duties, privileges and immunities, of inspectors, and limitations on their powers. The scientific-technical means of verification must be translated effectively into legal terms. One might note here the danger that, as the details of the application of safeguards are worked out with individual states, there may be an erosion of Agency rights.

Organizational Issues

In terms of organizational and related issues, some areas where the IAEA experience could be relevant are:

- The design and operation of an inspectorate, including the support services, the recruitment, training, retention and rotation of personnel, the designation of inspectors, and the effective use of personnel. The Agency has faced a number of problems in these areas, some specific to it and others which it shares with other international organizations. In comparison with some other international agencies, the IAEA's ability to deal with personnel issues in a way which seems to have preserved its credibility is all the more notable.

- The internal handling of information. Processing routines, security, and issues of information availability and of transparency in Agency activities are of interest. The handling of anomalies, of course, merits particular attention.

- The ability of the Agency to review and assess the effectiveness of its activities, to identify problems in its verification activities and to act effectively to correct these. The IAEA's Safeguards Implementation Reports and other evaluation procedures should be of interest here.

- The overall structure of the organization. What are its major organs; what principles apply to their composition, powers and procedures, and to their relations with each other? The nature of the IAEA's Board of Governors seems to have been a significant factor in the development and maintenance of the safeguards systems, but there has been a price paid for this politically. As well, what is the character of the relations between the political and the administrative sides of the Agency?

- What financial and other resources are needed for a verification agency? By what principles should contributions be assessed? The IAEA has had some budget controversies as its safeguards function has expanded. Would a CWC agency have multiple functions, as the IAEA has safeguarding and technical assistance functions, among others, or would it be centred on one primary function only? A single function would simplify some of the financing issues, but would not automatically solve them all.

Political Ramifications

In broader political terms, some of the matters noted already clearly have political ramifications. Even the setting of broad safeguard objectives can be seen as a political as well as a technical exercise. Among other considerations, we might note the following:

- One source of strain in nuclear non-proliferation has been the degree of separation between disarmament and non-dissemination. A chemical weapons verification agency would not face the same degree of difficulty, since it would be connected to a disarmament process.

- What connection, if any, is there between safeguards and supply? That connection has long been supportive of safeguards in the nuclear field, but this linkage could be reversed, with demands for assured access in return for acceptance of verification obligations. This, in turn, raises the whole question of handling the international market in chemicals, plant and technology.

- How can possible pressures for the development of multiple verification systems be handled? Even if they arise within the verification agency, such systems at least complicate the assurances that can be offered. If they arise outside of it as well, further technical and political difficulties can be foreseen. These pressures could arise not only from the existence of bilateral requirements between a supplier and a recipient or from the existence of other international organizations with a potential role in verification, but also from the problem of applying verification requirements to exports of plant and materials to non-signatories. There is also a problem if some states tend to interpret the international verification requirements as a ceiling while others see them as a floor. Problems could also arise if states not party to the founding agreement or not members of the verification agency nonetheless wish to use its services.

- Related to the issue of mandate, one could reasonably ask how a verification agency's activities — particularly given the limits of its threat coverage — might interact with those of other agencies, both national and international, to provide as a system an acceptable total verification package in terms of both threat coverage and level of assurance of compliance.

- The IAEA has benefitted from certain characteristics of its environment, such as the technical characteristics of nuclear goods and services and from the existence of supplier power in the international market for these goods and services. As this concentration has eroded, some difficulties

in safeguarding have arisen. Does the international chemical industry present similar possibilities and problems? The IAEA has also benefitted from the existence of a strong, although perhaps not universal, norm against the spread of nuclear weapons. Although an intangible factor, this should not be dismissed. What sort of political-market environment exists in the chemical area?

Conclusion

The IAEA experience sometimes provides specific suggestions as to how certain tasks could be accomplished and certain problems avoided. In other areas, its experience may provide negative lessons, a series of things to avoid. In still others, the Agency's experience may not suggest answers but could provide some clues or some thought-provoking parallels, or at least suggest some ways of approaching a question. As I argued earlier, the IAEA and its experience seem potentially of considerable value in considering a possible chemical weapons verification organization — not as a template, although we may identify certain problems and possible solutions, but as a sensitizing device. It is as valuable, perhaps, as a means of learning what more specific questions might be important and useful to ask, as it could be as a source of possible answers.

Notes

1. For details see: James F. Keeley, "IAEA Safeguards. Observations on Lessons for Verifying a Chemical Weapons Convention," *Arms Control Verification Occasional Papers* No. 1, (Ottawa: Department of External Affairs, 1988) Cat. No. E54-8/1-1988.

Chapter 4. THE IAEA Safeguards Model

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In the IAEA's case, we must distinguish between three objectives: legal, technical and political.

The Legal Objectives of Safeguards

Legally, IAEA's two systems differ in that the pre-NPT 1966 system, now only applied in non-NPT NNWS, seeks to prohibit every military use of nuclear material including every explosive use. The fact that this system prohibited every explosive use was implicit until 1975. It has been made explicit in all agreements since then — after India had claimed that its 1974 Pokharan test was a "peaceful" nuclear explosion. Of course, there is no such thing, because the physical processes and materials used in nuclear explosions for military and civilian purposes are the same. Nuclear weapon programs have usually begun with a nuclear explosive device that was not a weapon.

Under the NPT safeguards system, IAEA safeguards are applied to all nuclear material in all peaceful activities within the territory of the NNWS or under its jurisdiction or control anywhere. The legal purpose of such safeguards is safeguards is defined as being ". . . for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices." In other words, NPT safeguards only apply to nuclear material in peaceful activities and permit the non-explosive military use of nuclear material.

If the NPT had adopted the 1966 IAEA system banning every military use of nuclear material, Canada could not now be planning to acquire nuclear submarines.

There is a third category of agreements — those with NWS. They provide only that nuclear material may not be removed from safeguards except in accordance with the procedures set forth in the agreement. Under these agreements, it is the objective of "safeguards" (if the term may be used in this context) to verify compliance with this purely procedural requirement. The NWS may withdraw any plant or material from safeguards and use it for any military purpose provided it follows the prescribed procedures beforehand.

The object of these agreements was clearly not non-proliferation; the states concerned had already proliferated. It was, in the words of the German representative on the 1970 Safeguards Committee of the IAEA, an attempt to ensure "equality of misery." Safeguards were still regarded as a form of suffering requiring the victim to open a sensitive industry to foreign persons who might be industrial spies. In arranging to be safeguarded, the victim also incurred considerable expense. It was only fair that the U.S. and British nuclear industries should suffer as much as German, Italian or Japanese.

Henceforth I shall address only the NPT system since that is where most of the action is.

The Technical Objective

The technical object of NPT safeguards is defined as ". . . the timely detection of the diversion of significant quantities of nuclear material . . . and deterrence of such diversion by the risk of early detection." One may note that if safeguards are to be applied systematically and in a non-discriminatory way, three of the terms used require quantitative definition:

- What is meant, in numerical terms, by "timely detection"?
- What is meant by "significant quantity"?
- What is meant by the "risk of early detection"?

The Political Objective

There has been much confusion in the media about the authority of the IAEA and the aim of safeguards.

In the usual case a nation accepts safeguards freely and voluntarily. It does so chiefly in order to assure other nations (and sometimes even its own people) about the peaceful character of its nuclear activities. The task of the IAEA is to verify and certify that those activities are indeed peaceful.

Safeguards are thus a system of verification that enhances the credibility of the commitment the nation has made in ratifying the treaty or agreement concerned. Safeguards should be seen as a confidence-building measure, not in any way akin to that of policing or of law enforcement.

In recent years, emphasis has continued to shift from whatever deterrent role safeguards might play to the positive assurance they should give. This is no more than realistic. If ever a powerful nation like West

Germany or Japan or, for that matter, Canada or Sweden were to take the fateful decision to "go nuclear" — which is highly improbable — it would do so by denouncing the NPT and plunging ahead into a "crash" missile and weapon programme and not by diverting relatively inconsequential amounts of fissile material from its civilian nuclear fuel cycle. The deterrent effect of safeguards would be irrelevant.

Let us assume, however, that a state was unwilling to denounce its safeguards agreement and that it was to conclude that it had to have the bomb and the only way it could get it would be by diversion. It could be argued that this might have been Pakistan's predicament before it got hold of enrichment technology and when the only feasible source of plutonium was safeguarded spent fuel from the KANUPP reactor. There is no evidence that Pakistan diverted any material or even attempted to do so. But in my view, if ever a state did divert it would see to it that it was not caught with its hands in the till. It would simply make it impossible for the IAEA to apply effective safeguards, for instance, by impeding inspection, or by refusing to install effective monitoring equipment, or by any other administrative or legal impediment that an artful bureaucracy can devise.

This seems to be the type of situation foreseen by Paras. 18 and 19 of the NPT safeguards system. These clauses permit the Board to sound the alarm and impose statutory sanctions if the IAEA is unable to verify that there has been no diversion of nuclear material. It does not need to catch the diverter *in flagrante delicto.* Would a similar approach be appropriate in verifying a ban on the production of chemical weapons?

Structure

Effective international verification, in my view, ideally implies a single purpose organization, consisting of:

- a small executive body composed chiefly of the states that have a major interest in the success of the operation. The executive body should have full and exclusive authority over the operation.

- an assembly of all the states that are parties to the statute, treaty or convention. The main purpose of the assembly would be to enable the majority of members to give broad guidance to the executive body.

- a competent technical secretariat insulated as far as possible from the politics of the assembly and the executive body.

You may think I am describing an idealized version of the IAEA, but the picture does not fit exactly. Firstly the IAEA does not have a single purpose. In the mid-1950s, when we were drawing up the IAEA's statute, most of us believed that the peaceful atom would transform the world. It was inevitable that the IAEA should be charged with promoting atomic energy as well as safeguarding it. It was also believed that nuclear aid would "sugar the pill" of safeguards which were then seen as a novel intrusion into national sovereignty. In view of the obvious dangers involved in working in what was a novel field, it was also natural to ask the IAEA to promote nuclear safety.

None of this, surely, applies to the chemical industry. The chemical industry certainly doesn't need an international body to help it in the industrialized countries and seems to be doing well without special stimulus in many developing countries. Moreover, the amount of aid that would be needed to have any material impact would be stupendous. There might also be a conflict of interest between promoting, say, pesticide factories and trying to stop the spread of CW capabilities. Finally, a UN Industrial Development Organization already exists.

After Bhopal it might be argued that a CW organization could usefully take on some responsibility for promoting safety, but this too would require vast resources to have any meaningful impact.

My own view is that a CW organization should stick to its task, which will be challenging enough. The unfortunate experiences of UNESCO are the prime example of what can go wrong with a UN agency that has too many mandates. The IAEA's net is cast over a much smaller area, but there have been charges that its mandate to promote the use of nuclear energy conflicts with its regulatory role.

In one respect the IAEA does conform to the model. Its executive body, the Board of Governors, concentrates authority in a way that is almost unique in the UN system. The Board has sole intergovernmental responsibility for all safeguards matters. These range from the appointment of individual inspectors to making a finding of diversion, should it ever occur, and signalling its finding direct to the Security Council and to all members of the IAEA. The only safeguards role of the IAEA's General Conference is to approve the budget and it cannot even change that without the agreement of the Board.

The IAEA did begin with a small executive. The first draft of the Statute proposed a board of 11 countries. This soon grew to 16 (including all members of the negotiating group) and in the final version which came into force in 1957, the Board had 23 members. It has now risen to 35 with, I believe, considerable loss in executive competence. In the late 1960s and 1970,

the Board was able to implement two comprehensive safeguards systems; I doubt whether it could do a third today. Nevertheless, by international standards the Board still works relatively quickly and smoothly.

The IAEA has been able to shorten the duration of the General Conference to five working days and to hold it there. While the general debate may give broad guidance about the wishes of member states, political issues — particularly relating to Israel and South Africa — have loomed large in recent years.[1]

There is no doubt about the high level of technical competence of the staff of the IAEA. However, in recent years the UN has been paring away the allowances and pensions of its secretariat. Since the IAEA is a member of the common system it has had to accept the same fate. As a result, some of its best staff have taken early retirement and it has become more difficult to attract persons with the needed qualifications.

Politics influence the IAEA inspectorate in many ways but in two that are unique to the inspectors.

First, the Director General *consults* the Board before making any senior appointment to the staff of the IAEA — a director of a division or head of a department. The Board must *approve* the appointment of every inspector.

Second, every state is free to reject the Director General's proposals to assign particular inspectors to it. Most states do so, rejecting not only individual inspectors but whole categories, usually on grounds of nationality or in retaliation because their own nationals have been rejected by another state. This reminds every inspector that the status as an international civil servant ("exclusively international character," to borrow the language of the CW convention) cuts little ice. It also makes it more difficult to run the operation efficiently.

The draft CW convention seems deliberately to have avoided several problems the IAEA has encountered. It is thus surprising to see that its proposals for designation of inspectors[2] seem to be modelled on those of the IAEA; the more surprising since the Director General of the IAEA, Dr. Blix, has recently proposed some radical changes that would combine the appointment and designation procedures. Some governments have already accepted them.

There is one other aspect of "structure" that should be examined. Ideally, an arms control treaty should — as the INF does — specify in detail all the measures needed to ensure effective verification and that governments must automatically accept when they ratify the treaty.

The states negotiating the IAEA Statute and later the IAEA itself had to probe their way into unknown territory. They had to bear in mind the fate that had overtaken the over-ambitious Baruch Plan of 1946.

One consequence was that the IAEA followed a three-stage process. The 1957 Statute gave the organization generous, broadly worded safeguarding authority. The Board, as we have seen, found it necessary to translate this authority into two increasingly detailed safeguards systems. Third and finally, it has been left to the Secretariat to negotiate individual verification agreements with states.

Doubtless, this step-by-step approach was historically appropriate to a pioneering venture, but it led to a progressive dilution of the inspection rights of the IAEA. To give an example, under the 1957 Statute, IAEA inspectors were to have access "... at all times to all places and data and any person ... as necessary to acount for (nuclear material)." By the time the IAEA negotiated facility attachments under the NPT, the inspector's normal access was strictly limited to pre-determined strategic points and the precise maximum number of days that IAEA inspectors were allowed to be present was prescribed for each plant.

The "rolling text" of the CWC also spells out in considerable detail the verification measures that parties must accept. In an important respect it resembles the INF Treaty rather than the IAEA systems. Its first object is to verify the elimination of chemical warfare weapons within a specified period. When CW weapons have been eliminated, the central task of the CWC will be to verify that no more are produced, just as the task of IAEA safeguards is to verify the non-production of nuclear weapons.

Like the IAEA system, the CWC envisages the conclusion of even more detailed agreements with individual states to monitor the operation of plants producing key precursor chemicals (UN document CD/874 p. 83. — ANNEX TO ARTICLE VI [2] para.11.). In other words, it envisages a two-stage process. Although these individual agreements are to be based on a model agreement, one can foresee much hard negotiation in drawing up the model agreement and in working out a facility attachment with the manager of every plant.

Function

How does the system work? Briefly, the IAEA seeks to account as meticulously as possible for all nuclear material as this material moves through the national fuel cycle or crosses international frontiers. Technically, it is a system of material accountancy.

Such accurate accounting is helped by several factors that apply to the nuclear industry but not necessarily to the chemical industry.

First, the fact that the IAEA system is interested only in two elements, uranium and plutonium[3], and in two isotopes of uranium.

Second, the physical characteristics of nuclear materials — the fact that they emit different types of measurable radiation — usually makes it possible to account for the materials accurately, to distinguish between them when they consist of mixtures of isotopes or elements, and to assess their operational history.

Third, the nuclear industry is still relatively young, the volume of materials it processes comparatively small and it has been possible to keep track of most if not all nuclear plants and of much of the material.

Finally, the nuclear industry is still confined to a relatively small number of countries. The technologies that produce nuclear weapon material (reprocessing and enrichment) are carried on under safeguards in only five countries outside the weapon states: the F.R.G., the Netherlands, Brazil, Italy, and Japan. Six countries — Argentina, Brazil, Israel, Pakistan, India and South Africa — also operate unsafeguarded plants that have caused much concern but their fissile products usually stay at home.

The chemical industry is not only far larger, far more diversified and much older, it is also much more "democratic" in the sense that numerous plants all over the world are capable of producing chemical warfare agents. All this suggests that it will be difficult and perhaps impossible to use material accountancy as the means for monitoring the chemical industry, and that the IAEA's experience in this regard may be of little relevance. If this is correct, the fundamental requirement for the IAEA's system would not apply in a CWC, i.e., the IAEA's requirement that the state set up a national system to control and account for all its nuclear material.

Some of the four procedures the IAEA uses for material accountancy may, however, also apply under a CWC. They are:

- The IAEA examines the design of each nuclear plant. In the IAEA's case, this is chiefly in order to divide each plant into material balance areas and to determine the key points to which routine inspections will be confined.

The next two procedures may be less relevant, viz:

- The plant manager keeps precise accounting and operating records.

- Each month the plant manager sends the IAEA an inventory change report detailing all changes in the amount, composition etc. of nuclear material at the plant. The manager also submits a material balance report whenever stock is taken of that material.

- The fourth procedure, on-site inspection, will obviously play a major role in CW control, as it does for the IAEA, but the distinction between the various types of IAEA inspection (ad hoc, routine and special) seems irrelevant to a CWC.

On the other hand, the proposal that the CWC should provide for challenge inspections could, if accepted, be relevant for the IAEA. IAEA safeguards make provision for unannounced inspections at plants under safeguards and for special inspections that may be carried out at localities not specified beforehand, but they do not provide for the type of challenge inspection authorized by the 1967 Treaty for the Prohibition of Nuclear Weapons in Latin America and now proposed for the CWC.

At least in the case of the IAEA, it is likely that the value of challenge inspections would be largely to reassure the public and media that the IAEA could follow up suspect events and that in practice little use would be made of them. The IAEA has never deemed it necessary to carry out a special inspection and there has yet to be a Latin American challenge inspection.

The other techniques used by the IAEA, containment and surveillance, could be of great value to a CWC and to other arms reduction treaties. One of the chief containment techniques is the use of tamper-proof seals. This is of obvious relevance if CW stores are to be monitored and eventually destroyed. The INF Treaty foresees the use of surveillance equipment as an important means of verifying that no more medium or shorter range missiles are being produced.

Conclusion

Not only the IAEA's technical arrangements for applying safeguards but also its political history, structure and approach and its experience in dealing with sovereign states contain many lessons, positive and negative, for other endeavours to limit or eliminate weapons. There are, nevertheless, many elements in the IAEA's approach that are specific to a system set up to verify a particular on-going industry. It should also be borne in mind that many stages of the nuclear industry — processing of ore and concentrates, conversion into metal or UF_6 and reprocessing — are particular branches of the chemical industry.

There is, of course, one universally applicable and overriding factor: safeguards will work effectively only as long as governments, collectively and individually, want them to do so. Within this context, it is suggested that it is time to take the strait-jacket off the IAEA's safeguards budget.

Notes

1. There has been one notable exception: a special session of the General Conference in 1986 which dealt exclusively with nuclear safety in the wake of Chernobyl.
2. Except possibly for inspections carried out under Article IX.
3. Theoretically also in thorium which, when irradiated, produces a third isotope of uranium. No thorium has been used for this purpose except experimentally, and none has come under safeguards.

Chapter 5. Lessons from the IAEA Experience

5.1. The Chemical Weapons Convention and Some IAEA Experience*

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Introduction

Whereas the use of chemical weapons in the battlefield was possibly one of the most inhuman developments during World War I, the use of nuclear weapons against civilian targets was certainly the most terrifying event of World War II. In contrast to the development of chemical weapons, which was a side-product of a long-established and prosperous chemical industry, nuclear energy was introduced into our world as a means of threat and destruction.

It took more than 10 years until the constructive role nuclear energy can play in delivering reliable, low-cost electricity and in promoting science, medicine and technology was fully appreciated; and even now — 43 years later — nuclear energy is still stigmatized by the events of Hiroshima and Nagasaki.

It must, however, be realized that because of this dramatic first use of nuclear energy, its utilization for peaceful purposes was carefully controlled from its very beginning. The initial policy of complete denial of any transfer of nuclear technology was only later followed by the "atoms for peace" programme, accompanied by a widely accepted policy of striving for the non-proliferation of nuclear weapons.

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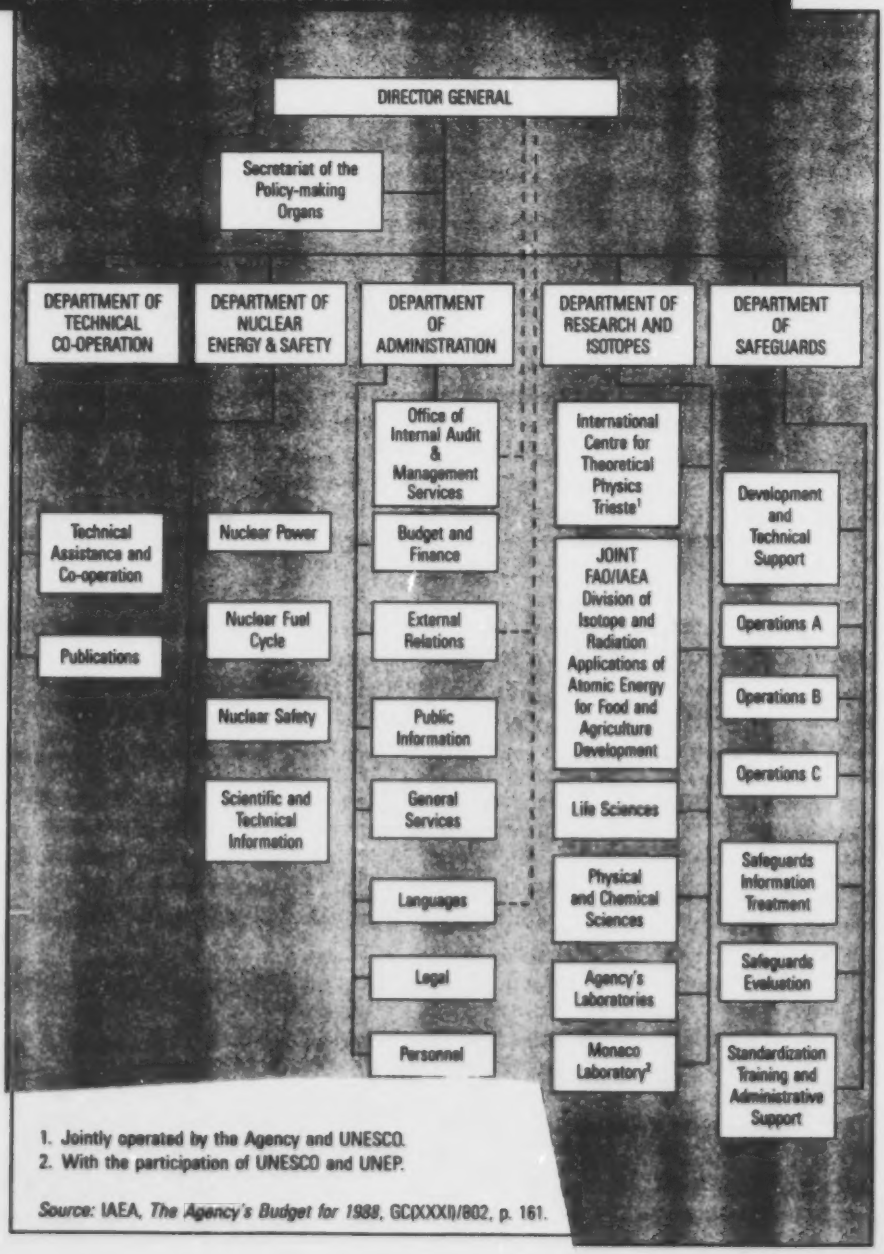
*This paper reflects the opinion of the author. It does not represent the official view of the IAEA nor of its Department of Safeguards. The paper is a reprint of an article published on pp. 175-186 of *Non-production by Industry of Chemical Warfare Agents: Technical Verification Under a Chemical Weapons Convention*; S.J. Lundin, editor; (SIPRI/Oxford University Press, 1988). It has been reprinted with the permission of the publisher, editor and author.

Figure 2. Organization Chart of the IAEA



1. Jointly operated by the Agency and UNESCO.
2. With the participation of UNESCO and UNEP.

Source: IAEA, *The Agency's Budget for 1988*, GC(XXXII)/802, p. 161.

The system of IAEA** safeguards to verify the peaceful utilization of nuclear energy is an important part of this international non-proliferation policy. Entrusted by its Statute, by the Treaty for the Prohibition of Nuclear Weapons in Latin America, by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and most recently by the South Pacific Nuclear Free Zone Treaty, the IAEA has developed its safeguard system during the last 25 years into a powerful instrument aimed at verifying that states are complying with certain fundamental non-proliferation undertakings.

The system embodies components of assurance as well as components of deterrence. It is designed to detect in a timely way any diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons, or of other nuclear explosive devices (or for purposes unknown) that might occur, to deter a diversion by the risk of early detection, in case a diversion is contemplated; and to give assurance that the states are in compliance with their safeguard obligations. IAEA safeguards are absolutely unique. It is the first time in the history of humankind that 97 sovereign states, comprising a majority of those countries which use nuclear energy, have agreed to accept international control, on their territories by an international organization in an area of important industrial development, thereby voluntarily accepting some interference with their sovereignty. This is without any doubt a very significant contribution to nuclear arms limitation and thereby to world peace.

By the end of 1987, a total of 166 safeguards agreements were in force with 97 states including the four nuclear-weapon states: France, the U.K., the U.S. and the Soviet Union. Through these agreements the following quantities of nuclear material were subject to IAEA safeguards: 9.4 tonnes of separated plutonium; 12.2 tonnes of high-enriched uranium (≥20% U-235); 224.2 tonnes of plutonium contained in irradiated fuel; 29 252 tonnes of low-enriched uranium; and 50 867 tonnes of source material (natural and depleted uranium and thorium).

In 1987 the Agency's Department of Safeguards spent about US$43.8 million and employed about 470 people (out of an IAEA budget of US$133 million and a total of about 1 700 IAEA staff). More than 2 100 inspections were carried out at about 600 facilities in 56 states by about 150 inspectors.

** The International Atomic Energy Agency (IAEA) was founded in 1957 with the objective "to seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."[1] The Agency is authorized to establish and administer safeguards to ensure that nuclear material, ... is not used in such a way as to further any military purpose. Other major activities of the IAEA relate to the promotion of nuclear power and its fuel cycle; of nuclear applications in human health, industry and earth sciences, physical and chemical sciences, nuclear safety and radiation protection as well as technical assistance and co-operation.

More than 320 automatic-photo or television-surveillance systems operated in the field and more than 12 000 seals were applied. About 1 300 samples from nuclear materials were analyzed, and about 3 600 analytical results were reported.

Although many, mostly minor, discrepancies and anomalies were found, all cases were satisfactorily solved. In 1987, as in previous years, no anomaly was detected which would indicate the diversion of a significant amount of safeguarded nuclear material. In essence, 95 per cent of all nuclear material in peaceful nuclear activities in the non-nuclear weapon states and some material in the civil fuel cycles in four nuclear-weapon states were subjected to IAEA safeguards which were applied successfully to it. Whereas between 1946 and 1968 the U.S. policy of denial had not prevented the development of nuclear weapons in four additional states, only one additional country has exploded a nuclear explosive device since 1968 when the Non-Proliferation Treaty came into being.

Table 5

IAEA: Department of Safeguards, 1987

Head Office: Vienna; Field Offices in Toronto (1980) and Tokyo (1984)
Operations A: Asia (except U.S.S.R.), Australia
Operations B: America, Africa, USSR, Europe (except EURATOM)
Operations C: EURATOM

Total Staff: 470
Number of Inspections: 2 133 at 631 Installations in 56 countries
Number of Discrepancies and Anomalies: 290
Number of Automatic Surveillance Systems: 320
Number of Seals: 12 500
Number of Samples for Destructive Analysis: 1 340
1987 Total Budget: (including Safeguards Information, Treatment Development and Technical Support, Technical Services, Evaluation, Standardization, Training and Administrative Support) $US43 792 000
1988 Planned Budget: (appropriation) $US49 493 000

Some Experience with the Safeguards System of the IAEA that might be Pertinent to the Verification of a Chemical Weapons Convention

Much experience has been gained and many lessons have been learned by establishing and operating the IAEA Inspectorate which might be of use in other arms control verification organizations, in particular for the control

related to a Chemical Weapons Convention (CWC). In this article only four related subjects are discussed: IAEA safeguards agreements and subsidiary arrangements, the inspector, the development and implementation of verification equipment and techniques, and the protection of sensitive information.

IAEA Safeguards Agreements and Subsidiary Arrangements

IAEA safeguards are implemented on the basis of safeguards agreements concluded between the IAEA and individual states or groups of states. Depending on the circumstances, these Agreements follow either the safeguards scheme described in INFCIRC/66[2] or the one described in INFCIRC/153.[3] The INFCIRC/66 scheme is used if the scope of IAEA is limited to such nuclear materials, other materials, equipment and facilities which are listed in a special inventory usually because they have been imported or their construction or use is related to imported relevant technological information. This scheme is characterized by the limited scope, according to the inventory described above, and the IAEA undertaking to apply its safeguards to all items on the inventory "so as to ensure that no such item is used for the manufacture of any nuclear weapon or to further any other military purpose or for the manufacture of any other nuclear explosive device." The INFCIRC/153 scheme is used in all non-nuclear weapon states party to the Treaty on the Non-Proliferation of Nuclear Weapons. It covers "all source or special fissionable material in all peaceful nuclear activities," and IAEA safeguards under this scheme are applied "for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices." This scheme is also used for the conclusion of safeguards agreements with states party to the Treaty for the Prohibition of Nuclear Weapons in Latin America and the South Pacific Nuclear Free Zone Treaty.

In these agreements the principles of safeguards to be applied are explained; the rights, privileges, immunities and obligation of the inspectors are described; and guidance on the implementation of safeguards is provided. INFCIRC/66 is, in effect, a general description of the main components of the safeguards agreement. The individual agreements following this scheme may vary quite substantially reflecting the specific range of application, for example, on a specific facility delivered from another country. The texts of INFCIRC/66 agreements also vary because this scheme has significantly developed since it was first used in 1966. INFCIRC/153 is a model agreement, and its text is to a large extent identical with the text of the individual agreements. The agreements with Japan and with the non-nuclear weapons states of the European Community and EURATOM deviate from the standard text through the addition of a protocol recognizing the specific features of the Japanese

safeguards system and of the EURATOM safeguards system. The safeguards agreements with nuclear-weapon states — which are usually called "voluntary offer agreements" — follow mainly the INFCIRC/153 scheme with certain adaptations reflecting the use of nuclear energy in nuclear weapons in these states.

Safeguards agreements are usually complemented by subsidiary arrangements describing, in their general parts, those components of the safeguards system which are relevant for the entire state, for example, channels and procedures for the flow of information, the national system of accounting for and control of nuclear material, co-ordination of inspection programmes and report forms and explanations of their use. The facility-specific safeguard measures are described in facility attachments which are individually negotiated and concluded for each facility. These facility attachments are prepared and negotiated on the basis of facility-specific design information provided by the state and a design-information verification visit by some inspectors. For many facility types, model-facility attachments have been developed with the assistance of international groups of experts and are being used within the IAEA.

The Inspector

The inspector is the most important element in any scheme of verification through human observation. All assurances provided, all questions regarding results and all potential detection of deviations from international, binding undertakings devolve upon the inspector. His/her capabilities, reliability, integrity, and also his/her reputation and credibility are the ultimate pillars of the verification regime. This key role of the inspector must be kept in mind whenever international verification is being discussed.

IAEA inspectors are recruited from the widest possible geographical distribution; technical competence and experience in the nuclear field are essential criteria for recruitment.[4] During the first three months, new inspectors are trained in the basic aspects of safeguards, including Non-Destructive Assay (NDA) measurement technology, record auditing and the use of statistical-sampling plans. In the following six to nine months inspectors receive in-field training under the supervision of experienced senior inspectors. Depending on their experience and training they may be employed on a P-2, P-3 or P-4 level.[5] P-5 level senior inspectors have usually long-term IAEA experience or special safeguards experience in a national or multi-national system for nuclear-material accountancy and control. If possible and if good performance permits it, the IAEA tries to secure the services of inspectors for an extended period of time. However, there are no permanent contracts available. After a first three-year and a subsequent two-year contract, five-year extensions are usually possible.

The work of an inspector is not easy and puts a great strain on health and family relations. Heavy travel schedules and long absences from home characterize the work. The professional requirements are high: technical knowledge and competence, diplomatic skill, language capabilities, reliability, integrity, good health, flexibility and so on. The trend in the UN system for more economy, the decreasing quality of working conditions, the increasing uncertainty with respect to long-term employment and the limited prospects for career development hamper the recruitment of qualified staff and have led to some early resignations.

The standards for inspectors employed for the verification of compliance with a CWC may even be higher: more travelling to more remote places, direct handling of highly toxic substances, detailed technical knowledge of several completely different types of chemical compounds, and the related micro-analytical detection methods. Knowledge of chemical-weapon design and their employment may be additional important requirements.

Furthermore, it must be recognized that because of the present stagnation in the nuclear industry in developed countries enough qualified persons with nuclear experience can be found. The chemical industry, however, is in good health, and qualified persons will relatively easily find satisfactory or attractive positions in chemical enterprises. Specific training will be indispensable and good prospects for career development should be available. In addition, long-term (permanent) contracts might be required in order to ensure the necessary staff loyalty to the organization.

Development and Implementation of Verification Equipment and Methods

The verfication of any advanced, highly sophisticated technology, such as the nuclear or chemical industry, requires well-developed and reliable instruments and methods.

In 1970, when the IAEA was entrusted, through the NPT, with the task of designing, implementing and successfully maintaining an extended international system for safeguarding nuclear materials in all peaceful applications, only very limited experience in nuclear-material safeguards was available. Furthermore, this experience was mainly based upon safeguards at nuclear-power reactors and research reactors. The main task for the following years was to develop procedures and techniques for applying safeguards throughout the nuclear fuel cycle including large bulk-handling facilities. Extensive research and development (R&D) activities were initiated covering, *inter alia*:

- studies on safeguards concepts and approaches;
- the development, testing, implementation and maintenance of safeguards instruments, methods and techniques;
- the development of safeguards information and data-treatment capabilities;
- the assessment and evaluation of safeguards results;
- the training of safeguards inspectors; and
- the performance of safeguards inspections.

In principle, there were two possible ways of tackling the first three tasks: 1. to provide the IAEA with the required (and very high) budgetary resources to build its own R&D facilities and to employ a large number of researchers; or 2. to conduct the necessary work in national R&D facilities in close co-operation with the IAEA and to provide the IAEA with the necessary limited resources and funds required for the co-ordination of the work and for the proper utilization of the results.

It is not surprising that, in a situation of financial shortage and a certain over-capacity in national nuclear R&D programmes and facilities, most Member States preferred to have the work done in their own facilities. Several formalized routes have been established and used for the co-ordination of the work and the transfer of results to the IAEA. These include:

- conclusion of safeguards research agreements and contracts (inside or outside formalized co-ordinated research programmes);
- participation in safeguards consultant or advisory-group meetings and working groups;
- establishment of national programmes in support of IAEA safeguards; and
- participation in multinational programmes aimed at the improvement of IAEA safeguards.

The last two routes turned out to be extremely useful and most of the R&D work related to IAEA safeguards has been carried out and continues to be performed under national or multinational programmes in support of IAEA safeguards.

Thus far 11 states (Australia, Belgium, Canada, France, the F.R.G., Italy, Japan, the U.K. the U.S., the U.S.S.R. and Sweden) and EURATOM have entered into formalized safeguards support programmes with the IAEA and four major multinational programmes for promoting safeguards in specific situations (IWG-RPS,[6] TASTEX,[7] RECOVER,[8] HEXAPARTITE[9]) have been executed. Practically all instruments, methods and techniques which the IAEA employs in implementing its safeguards are a result of these programmes. In addition numerous cost-free experts and other expertise have been made available to the IAEA in the framework of these programmes. The co-ordination of these programmes with the requirements of the IAEA and the proper co-operation is a major task of the IAEA Division of Development and Technical Support, and represents about seven full person-years of work per year.

Consultant and advisory-group meetings are important complementary means of obtaining expert advice and information. Once every four years, the IAEA organizes a major safeguards symposium which usually attracts some 300 experts, covering the development in all fields of safeguards R&D and implementation experience.

Safeguards research agreements and contracts played a major role in the early 1970s, before the support programmes were initiated. Now they are only used in rare cases where the required expertise or equipment cannot be obtained otherwise.

Safeguards instruments and the procedures for their use during inspection are not readily available and frequently require development[10] over several years in specialized research and development facilities. The steps leading to a fully suitable instrument include:

- definition of the purpose of the instrument and the conditions under which it shall be used;
- development of a laboratory device to demonstrate the feasibility of the technique under ideal laboratory conditions;
- production of a development prototype for evaluation, limited field testing, development of provisional procedures, manuals and safety analysis;
- production of field-evaluation units for testing the technique under routine field conditions, training of inspectors, determination of the range of applicability, for reliability and tamper-resistance analysis and for the development of specifications, production drawings, operation manuals, maintenance and preventive-maintenance procedures;

- production of commercial instruments for routine use; and
- equipment-performance monitoring for further improvement, continuous training of inspectors in the use of the equipment and, if possible, adaptation of the instrument and operating procedures to new situations and developments in the field.

Each of these steps may take many months to several years, depending on available resources, expertise and testing possibilities.

For the chemical analysis of samples taken from process lines in nuclear facilities, the IAEA operates its own Safeguards Analytical Laboratory (SAL) and co-operates with a network of safeguards analytical laboratories in 14 Member States.[11] The IAEA's Safeguards Analytical Laboratory is equipped with the necessary instruments to analyze about 1 200 safeguards samples a year. Since the handling of plutonium and other radioactive materials requires careful protection of the operators and the environment, glove boxes, air-control systems with filters and shielding are installed. The measurement equipment is computerized to a large extent.

Although the analytical procedures used in SAL are the standard procedures used in nuclear industry, certain modifications and adaptations were required in order to take care of the relatively long transportation time for the samples, the different sample-preparation techniques used in different countries and the specific composition of the material from which the samples are taken. Sample transportation frequently requires particular attention since the rules and regulations for the safe transport of plutonium and other radioactive materials are very stringent and sometimes differ in different countries.

R&D for verification techniques related to a CWC will be very essential. Again a decision will be necessary about whether the organization should have its own major R&D facilities or whether it should rely mainly on the R&D work done in the Member States. Some countries (for example, Finland, the Netherlands and Norway) have already done some research for CWC purposes, and it will be essential that the available results are properly transferred into practical application by the inspectorate. But much more work needs to be done. At this time about US$15 million are being spent annually in the R&D activities covered by national programmes in support of IAEA safeguards, a continuing activity that started in 1976. Related activities in Member States may easily exceed this annual spending.

A comprehensive system of instruments, methods and techniques for the purpose of the CWC will certainly require the same effort — if not more.

In addition, analytical laboratories capable of handling and analyzing the samples collected by the inspectors need to be available to the organization. Even if most R&D work and analytical services are done in Member States, a sufficiently large group of staff is required within the organization in order to co-ordinate the work, to evaluate the results obtained and to perform routine services.

The implementation of verification equipment and methods is not always easy. Equipment must comply with national regulations and must work reliably under field conditions. Neither is trivial and specific adaptation may be required. For example, the colour-coding of cables connected to the main electricity supply is different in different countries. National regulations require the use of correct colours and that means that a specific instrument which is cabled in accordance with the rules of a particular country may not be used in other countries. Frequency and voltage of electricity is different in different areas of the world, but also the ranges of the frequency and voltage actually available may vary considerably. Power shortages may lead to 20 per cent below normal voltage and reduced frequency and in some countries to power cuts for several hours every day. In addition, electrical noise is quite significant in certain facilities. Robust, preferably battery-operated, instrumentation might be the only solution to this kind of problem. On the other side, the inspection activities must not interfere with safety, security or economic requirements of the inspected facility. The question of liability may come up if inspection activities require unusual handling or operation. Sampling of material may cause leakages or contamination. Items may be damaged during measurement or movement to or from measurement. In principle, any kind of verification is intrusive and may interfere with normal operation. Through careful planning and preparation the potential damage can, however, be minimized or at least reduced to an acceptable level. The IAEA has occasionally reported on the difficulties it experienced when a new verification instrument or technique was implemented. Not all instruments and methods can be used equally everywhere — indeed differences in national regulations or licensing conditions provide for more flexibility in some countries than in others. It has, however, usually been possible to avoid this kind of difficulty by using alternative safeguards instruments and procedures.

Protection of Sensitive Information

During the discussion of verification measures for a CWC, concern has been expressed that commercially sensitive information and/or industrial secrets may become known to the inspectors and/or the organization and could be misused for illegitimate purposes. Similar concern has been expressed repeatedly with respect to the implementation of IAEA safeguards since the nuclear industry is considered a technologically sensitive area. Thus the question of protection of information and the measures taken by the IAEA may be taken as a model for a CWC. Measures taken by the IAEA include:

- *Statutory and Contractual Obligations*

The Statute of the IAEA requires that only persons of the "highest standards of efficiency, technical competence and integrity" (Article 7 D) be recruited and employed and that "In performance of their duties ... the staff shall not seek or receive instructions from any source external to the Agency ... they shall not disclose any industrial secrets or other confidential information coming to their knowledge by reason of their official duties for the Agency ... (Article 7 F). In addition, all safeguards agreements include provisions obligating the Agency to keep confidential information secret. Relevant requirements are contained in Articles 5 and 9 of the safeguards model agreement for non-nuclear weapon States Parties to the NPT, reproduced in document INFCIRC/153.

Article 5 requires, *inter alia*, that "the Agency shall take every precaution to protect commercial and industrial secrets and other confidential information coming to its knowledge in the implementation of the Agreement. The Agency shall not publish or communicate to any State, organization or person any information obtained by it in connection with the implementation of the Agreement, except that specific information ... may be given to such Agency staff members as require such knowledge by reason of their official duties ... but only to the extent necessary. ..." Article 9 contains the requirement that "the visits and activities of Agency inspectors shall be arranged as to ... ensure protection of industrial secrets as any other confidential information coming to the inspectors' knowledge."

In addition, other procedures and measures are foreseen in the model. For example it is stated in Article 8 that "the Agency shall require only the minimum amount of information and data consistent with carrying out its responsibilities under the Agreement. Information pertaining to facilities shall be the minimum necessary for safeguarding nuclear material subject to safeguards under the Agreement. In examining design information the Agency shall ... be prepared to examine on premises of the State design information which the State regards as being of particular sensitivity" and so on. Two measures to protect information or secrets are explicitly mentioned here: minimizing the (sensitive) information available to the Agency and examining of information on the premises of the state — thereby minimizing the distribution by the state and controlling access of Agency staff to such information.

Furthermore, the state has to give its consent to the designation of inspectors that may perform inspections on its territory (Article 9).

Process steps involving commercially sensitive information may be protected by establishing a special material-balance area around them (Article 46b IV). Access of inspectors is limited to "locations where nuclear material is present" (Article 76a) or "only to strategic points specified in a subsidiary arrangements" (Article 76c). If unusual circumstances require extended limitations on access by the Agency, arrangements have to be made — and reported to the Board — which enable the Agency to discharge its safeguards responsibilities in the light of these limitations (Article 76d). The state has the right to have inspectors accompanied during their inspection by representatives of the state (Article 87) and the number, intensity, duration and timing of routine inspections is to be kept to the minimum consistent with the effective implementation of the safeguards procedures (Article 78). With respect to a non-proscribed military use of material to which safeguards are not being applied while the material is used in such an activity, it is explicitly stated that: "the Agency's Agreement ... shall not involve any ... classified knowledge of the military activity" [in which the material is being used] (Article 14C).

- *Related Administrative Procedures*

Related administrative procedures are contained in the Provisional Staff Regulations and Staff Rules, the other chapters of the Administrative Manual, the Safeguards Manual and specific instructions issued by the Head of the Department of Safeguards, Directors or other supervisors.

Staff Regulation 1.01 states: "Members of the Secretariat are international civil servants ... By accepting the appointment they pledge themselves to perform their duties ... with the interest of the IAEA only in view." Regulation 1.06 requires that "Members of the Secretariat shall exercise the utmost discretion in regard to all matters of official business. They shall not communicate to any person or Government any information known to them by reason of their official position which has not been made public, except in the course of the performance of their duties or by authorization of the Director General. They shall not at any time use such information to private advantage... These obligations shall not cease upon separation from the Secretariat."

The oath or declaration to which members of the Secretariat shall subscribe states, *inter alia*, "I solemnly swear ... to exercise in all loyalty, discretion and conscience the functions entrusted to me as an international civil servant. ..." (Regulation 1.11) and Regulation 11.01 states that "the Director General may impose such disciplinary

measures as are in his opinion appropriate on staff members whose conduct is unsatisfactory. He may summarily dismiss a staff member for serious misconduct."

Rule 1.06.1 on classified information reads as follows:

> *A. The Director General may from time to time establish (a) classes of information to be subjected to safekeeping, and (b) procedures to be followed by staff members for the safekeeping, handling and release of information so classified.*
>
> *B. Non-compliance with procedures established under para A. above shall constitute a conduct calling for appropriate action under Provisional Staff Regulation 11.01.*

The classes and procedures mentioned in Rule 1.06.1 have been established by the Director General (SEC/NOT/956) and a *Manual of Standards for the Classification, Routing and Safekeeping of Safeguards Information* has been issued by the Head of the Department of Safeguards. These two documents contain instructions on classification, protection procedures, destruction, declassification, security officers, file stations for confidential information, safes, electric locks and so on. Thus far their implementation, although sometimes inconvenient, has not led to major problems. It should be noted that similar procedures apply to the protection of confidential information on magnetic tapes, disks or stored in computers.

Experience With the Protection of Sensitive Information

In general it can be stated that the relevant obligations and administrative procedures are considered sufficient. It must moreover be realized that the best rules and procedures cannot absolutely exclude the possibility of illegal access to confidential information through robbery, accidents or misconduct of individual staff members, but those events are rare and have not thus far led to major controversies. Although it might be difficult for an international organization to prosecute staff guilty of misconduct and to hold someone accountable in the case of defection, it can be expected that the involved Member States would take the appropriate actions to protect the interests of the organization.

In some cases, Member States have requested unnecessarily stringent protection measures: for example, the Agency was requested to keep information confidential which was publicly available in brochures or scientific publications. In very few cases the standard rules were considered insufficient and additional security procedures have been agreed upon. These special procedures included, *inter alia*: (a) the development and review of surveillance films in the facility or in the state, without physical transfer of the films to IAEA offices; and

(b) special-access procedures to areas containing commercially sensitive information, such as procedures for announcement of inspections, limited frequency of access, limitations on the number of inspectors, reduced duration of access, predetermined routes for inspectors, recording by an accompanying representative of the state only and the like.

In general, one can observe that the concern that the IAEA may not properly treat confidential information is declining. There is also a visible trend to ask the Agency to give more and more detailed information on safeguards implementation to its Board of Governors and through its Annual Report to the public. It is widely accepted that the advantages of providing confidence for the IAEA safeguards system through a higher degree of transparency may outweigh the disadvantages of releasing some less sensitive summary information. From this trend one can only hope that the sometimes over-emphasized concerns with respect to the treatment of sensitive information by the CWC control organization will disappear once the system has been established and brought into operation.

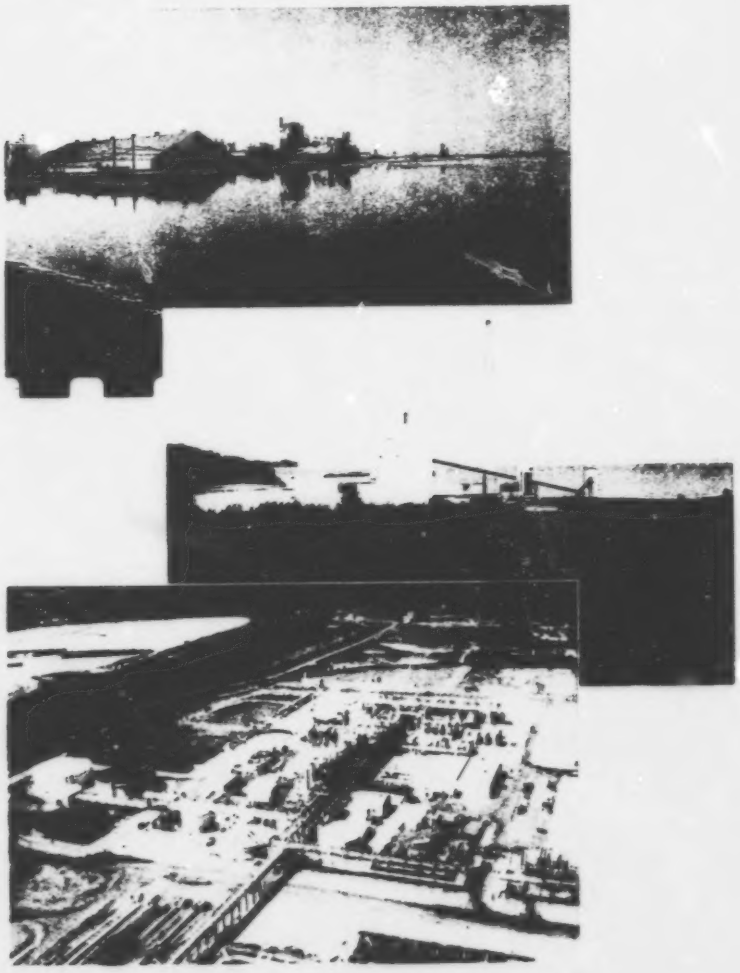
Outlook

The inspectorate envisaged for the verification of compliance with the basic undertakings related to a CWC will have an important and challenging task. In some respects, this task will have certain similarities with the IAEA system for safeguarding nuclear material; in other respects, the task will be new and unprecedented. Application of IAEA safeguards is strictly limited to the peaceful utilization of nuclear energy. None of these activities are related to nuclear arms or other uses of nuclear energy in military applications. The chemical-weapon verification inspectorate will have to deal not only with the verification of non-production of certain substances but also directly with the control of storage and destruction of chemical weapons and the termination of their production in chemical-weapon factories. In addition, nuclear-material safeguards are based on material accountancy related to three chemical elements: thorium, uranium and plutonium, with thorium having little importance. All three elements are radioactive and can therefore be detected and measured by non-destructive assay techniques. Uranium and plutonium are used practically exclusively in nuclear activities and therefore — except for material in military application — in most non-nuclear weapon states are fully under IAEA safeguards. In contrast, the verification of non-production of chemical weapons is based on the agreement that certain compounds are not being produced, or only being produced in small quantities for non-proscribed purposes. The elements from which these compounds are synthesized are easily available everywhere and uncontrollable, and compounds similar to those used in chemical weapons are widely used in the pharmaceutical industry, the chemical industry and in agriculture. Facilities and equipment

Figure 3 Nuclear Industry versus Chemical Industry Scope of the Problem

Clearly, any arms control verification system applied to industrial processes, such as IAEA safeguards, has lessons to teach those concerned with the verification of a ban on chemical weapons. Nevertheless, there are important differences between the nuclear industry and the chemical industry that limit the applicability of these lessons. Among the most critical of these differences are the immense size and diversity of the chemical industry. There are many thousands of chemical plants around the world producing or using a wide range of chemicals potentially

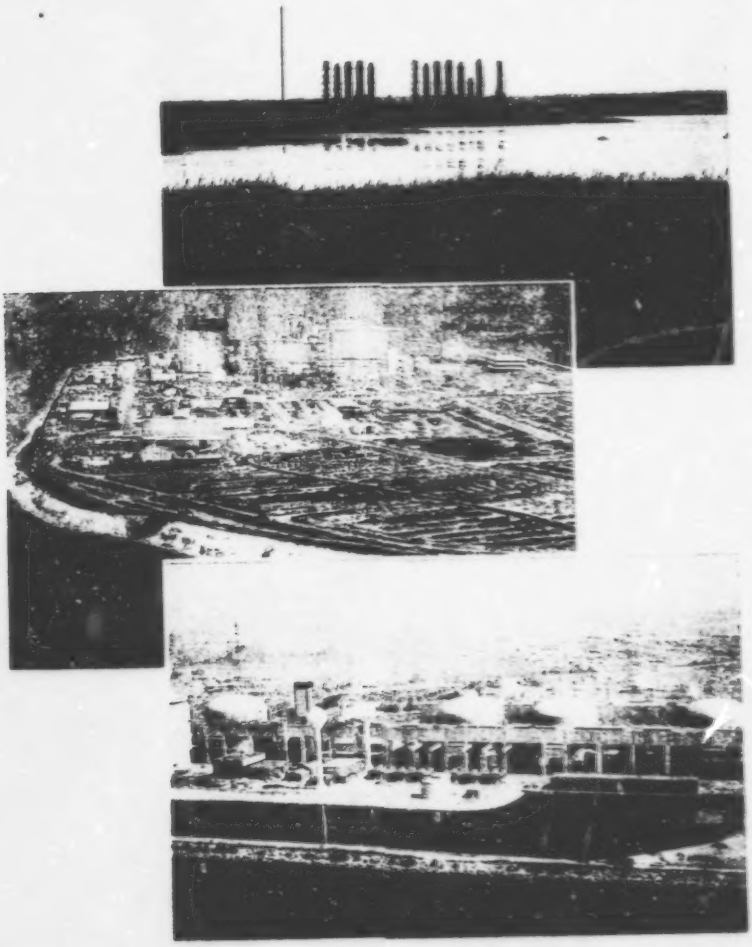
Chemical



subject to the monitoring and data-exchange requirements under a comprehensive CW agreement. In contrast, the IAEA monitored approximately 900 facilities worldwide in 1986.

By international standards, Canada is not a major producer of chemicals of current concern to the proposed Chemical Weapons Convention, yet there is a considerably higher number of chemical plants in Canada than nuclear facilities subject to IAEA safeguards. These pictures illustrate some of the nuclear and chemical facilities across Canada.

Nuclear



Photos: SSC Photo Centre ASC

used for the production of weapon-usable chemicals are identical to those used for the production of insecticides, herbicides and other chemical products.

And finally, the primary purpose of the IAEA safeguards system is to build up confidence that the non-nuclear weapon states accepting full-scope safeguards are not diverting nuclear material and technology for the production of nuclear weapons or other nuclear explosive devices, thereby providing a basis for international co-operation and technology transfer and eliminating the need for other (neighbouring) countries to enter into a nuclear-arms competition. This is significantly different from the main purpose of a CWC which is to reduce and eventually eliminate existing stockpiles of chemical weapons. A very high degree of confidence and assurance will be required to convince the states armed with chemical weapons that the dismantling of their chemical arsenals is in the best interest of everybody and not placing their legitimate national interests in jeopardy. It is obvious that one cannot simply copy the IAEA safeguards system in the CWC inspectorate; the environment of the system, the determining parameters external to it and the assurance to be provided through it are substantially different. However, IAEA experience in international co-operation in setting up an international-verification inspectorate, its structure, staff rules, working procedures, evaluation criteria and so on may serve as a model for the organization of the CWC. Other models less close to the IAEA safeguards system could be developed, for example those emphasizing bilateral-verification arrangements with little international verification. In this article the attempt has been made to describe, in four specific areas, how the functioning and organization of the IAEA might be of use in developing structures and concepts for the verification organization required in the context of the Chemical Weapons Convention.

Notes

1. *Statute* of the International Atomic Energy Agency.
2. *The Agency's Safeguards System*, INFCIRC/66/rev.2 (IAEA: Vienna, 1968).
3. *The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, INFCIRC/153 (corrected) (IAEA: Vienna, 1972).
4. Buechler, C. and Lichliter, W., *Career Prospects in the IAEA Safeguards Inspectorate*, IAEA SM 293/114(IAEA: Vienna, 1987).
5. *Report of the International Civil Service Commission for the Year 1987*, UN Official Records Supplement, no. 30 (A/42/30), New York, 1987, p. 107.
6. *International Working Group on Reprocessing Plant Safeguards, Overview Report to the Director General* (IAEA: Vienna, 1987).

Notes cont'd.

7. *Tokai Advanced Safeguards Technology Exercise*, Technical Report Series, no. 213 (IAEA: Vienna, 1982).

8. Sanatani, S. and Neilsen, C.J., *A Remote Verification System for International Safeguards: Status of the RECOVER Programme in the IAEA*, IAEA SM 260/110 (IAEA: Vienna, 1983).

9. Brown, F., *The Hexapartite Safeguards Project: A Review by the Chairman*, IAEA SM 260/57 (IAEA: Vienna, 1983).

10. Rundquist, D., "Improving technical support to IAEA safeguards," *IAEA Bulletin* (Vienna), vol. 28, no. 4 (1986), p. 29.

11. Deron, S. and Wenzel, U., "Safeguards analytical services: their role in verification," *IAEA Bulletin* (Vienna), vol. 28, no. 4 (1986), p. 24.

5.2. Operational Considerations*

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Protection of Sensitive Information

The International Atomic Energy Agency has been able to deal successfully with the problem of access to sensitive information, meaning information that is commercially or industrially sensitive or proprietary. Agency safeguards do not extend to non-peaceful nuclear activities and the issue of national security sensitive information does not, therefore, arise. In the case of safeguarded nuclear material that is removed from safeguards for use in a non-proscribed military activity (as permitted by the Treaty on the Non-Proliferation of Nuclear Weapons), it is specifically provided in the relevant safeguards document (INFCIRC/153) that the safeguards agreement "shall not involve any classified knowledge of the military activity" in which the material is being used. (153/14c).

Sensitive information is dealt with by the IAEA at several levels:

- The Agency's Statute provides (article 7 F) that staff "shall not disclose any industrial secrets or other confidential information coming to their knowledge by reason of their official duties for the Agency."

- The basic IAEA safeguards documents (INFCIRC/153 for NPT parties and INFCIRC/66 REV.2 for situations in which only specified items on an inventory are subject to safeguards) give substantial attention to protecting the rights and interests of safeguarded states. Safeguards agreements negotiated pursuant to those documents, and which provide the basis for the application of safeguards, contain provisions requiring the Agency to keep confidential information secret. This includes obligations taken by the Agency not to communicate information obtained in the course of implementing safeguards agreements except insofar as specific information may be given to staff members requiring such information by reason of their official duties, and then *only* to the extent necessary (INFCIRC/153, para. 5). Thus, the availability of information is limited to a "need to know." Elsewhere, the basic safeguards agreement admonishes the Agency to require only the minimum amount

*The author wishes to acknowledge the importance to his article of the contribution by Dr. von Baeckmann which appears on page 37 of these proceedings.

of information necessary to carry out its responsibilities; and it further provides that certain information such as design information of particular sensitivity may be examined only on the premises of the state.

The basic safeguards documents contain a number of additional provisions relevant to protecting information. These include limiting access of inspectors to defined locations in a facility (e.g., to where nuclear material is located, or to strategic points designated in the subsidiary arrrangements of a safeguards agreement) (INFCIRC/153, para. 76), establishing special material balance areas around processes, and keeping the number and intensity of inspections limited to the minimum consistent with effective implementation of safeguards (INFCIRC/153, para. 79). All these measures are aimed at protecting the state and facility operator by minimizing safeguards intrusiveness and the risk of exposure of commercially sensitive or industrially proprietary information.

Administrative measures in the form of staff rules and regulations to implement these principles also have been put in place. These include issuance, by the Deputy Director General for Safeguards, of a manual of standards for the classification, routing and safekeeping of safeguards information.

In a limited number of situations, these rules have been augmented by additional measures such as limiting the number of inspectors permitted access to an area containing sensitive information, or limiting the duration of access, or requiring that information to be recorded be done by a state representative accompanying the inspector. Furthermore, each state must give its consent to the designation of inspectors that may conduct inspections on its territory, thereby providing yet another protection against concern about access to and dissemination of sensitive nuclear information.

There is a tension between interest in *confidentiality* of information on the one hand, and demand for increased *transparency* of safeguards by providing more and more detailed information on safeguards implementation in the name of increasing *credibility*, on the other. Optimizing between these two values is a problem of political choice that may be even more significant in a Chemical Weapons Convention due to the even more intense degree of competition in the world chemical market than in the nuclear market and the resulting likely higher sensitivity regarding proprietary information.

The bottom line here, however, is that the IAEA safeguards implementation experience demonstrates the acceptability and feasibility of *international verification* of activities involving sensitive information in a manner that protects such information while providing an adequate basis for third party confidence in the findings and evaluation of the verification exercise.

Safeguards Research and Development

There are several key points to be made here:

- Continuing development of high-technology industries like nuclear energy, communications and chemicals means continuing new challenges to verification of activities to be monitored. This goes along with the need to improve on existing capabilities in the interest of greater effectiveness and efficiency and less intrusion.

- Theoretically, research and development could be managed by providing the verification organization with resources for direct use or by allocating the work to national research and development facilities acting in co-operation with the verification agency. This is the way that was chosen by the IAEA and today nearly $15 million in research and development work is done by 11 national support programs and several multinational projects working in support of IAEA safeguards. For its part, the IAEA serves as co-ordinator, although co-ordination has not proven to be as efficient as desirable, leading the Agency to work toward improving its co-ordination effort.

- Research and development is one thing; deployment is another. Two experiences of the IAEA are relevant here. One is the reluctance of states and/or operators to allow the use of some of the technological advances achieved, for example, non-destructive verification techniques, some of which are quite acceptable surrogates for destructive chemical analysis, insofar as achievable accuracies are concerned. There are several reasons for this reluctance including legal requirements for compliance with licensing arrangements in the case of instruments; liability problems in the case of a request by the inspector to the operator to move material so that it may be measured; or safety problems associated with new instrumentation (e.g., a neutron source) or with procedures requested by an inspector. Second, the IAEA relies primarily on material accountancy, but also uses as a supporting measure, containment and surveillance. Surveillance equipment has had difficulties in the past and one approach has been to work to improve it. Improvement can lead to new devices, the introduction of which is *not necessarily accepted by the operator or by the state authorities*. Another approach is to back up containment and surveillance with *redundant* measures. But here too, the IAEA can and has run into resistance on the grounds that the proposed measures are either unnecessary, inappropriate or both.

The first problem — new techniques or instruments — relates to the differences between a strict and a liberal construction of agreements for safeguards implementation. It suggests the problem of constructive co-operation to which I will return momentarily. It also suggests the potential value of *joint development* of verification instrumentation and measures. While not an absolute guarantee of avoiding the problem of acceptability, joint development may facilitate deployment. Co-ordination of development strategies by the verification organization among potentially affected key parties is highly relevant here.

Dealing with Anomalies

The concept of anomaly is important to IAEA safeguards. Those safeguards do not detect diversions in the sense of witnessing theft, diversion or misuse of nuclear material. What is detected is an anomaly, i.e., "an unusual observable condition which *might* result from diversion or misuse or which frustrates or restricts the ability of the IAEA inspectorate to draw the conclusion that diversion or misuse has not occurred." (IAEA Glossary, para. 25.) In other words, an anomaly is not conclusive but only indicative of a possibility of a diversion. Once having identified an anomaly and having reviewed other available information, the Agency makes a decision whether or not to interrogate the anomaly (for example, in the case of material accountancy-based anomalies the Agency may use statistical tests to determine whether and how to proceed).

Two observations can be made about anomalies as dealt with by the IAEA:

- The approach to resolving anomalies is incremental — the procedure starts within the organization, moving through prescribed review channels, and, if necessary, then follows a prescribed path in relations between the Agency and the state involved.

- Efforts to resolve or clarify anomalies are done *quietly and within house* — not with public display in the political limelight. It is not a case of Zola's *J'Accuse*, but rather an effort to seek the co-operation of the state involved in clarifying discrepancies and uncertainties. This is so because a primary purpose of IAEA safeguards is to facilitate demonstration by a state of its compliance with its international undertakings. This provides a positive dimension to verification without sacrificing development and application of measures necessary to give third parties confidence in the procedures and in the findings.

Inspection Timing

The IAEA is authorized to conduct three kinds of inspections: ad hoc (e.g., for verification of initial reports or international transfers of safeguarded

nuclear material); *routine* (the frequency of which is laid down in facility attachments negotiated between the safeguarded party and the Agency and which range from less than one inspection a year to continuous presence of inspectors); and *special* (for example in the case of an unresolved anomaly). Experience is primarily in the area of routine inspections. The IAEA does not have any provision for so-called "challenge" inspections such as are provided for in the Latin American Nuclear Weapon Free Zone (Tlatelolco) Treaty and in the Intermediate Nuclear Forces (INF) Treaty.

On the whole the routine inspection system has worked quite well, providing a credibility that has earned the confidence of the non-proliferation community. This general conclusion is subject to a number of caveats.

- The Statute provides for a very broad right, namely "access at all times to all places and data and to any person" who by reason of his/her occupation deals with materials, equipment and facilities which are required to be safeguarded. In reality, the agreements negotiated under the predominant safeguards document of the IAEA, INFCIRC/153, have placed limits on this broadly stated right and reflect a preference for emphasizing access to defined strategic and key measurement points.

- Inspectors depend on availability of comprehensive and timely reports which are to be verified. Timeliness of reports, however, has proved to be a problem that adversely affects the efficiency, not to speak of the effectiveness, with which verification activities can be carried out.

- Sometimes, for quite legitimate reasons, inspectors cannot carry out activities at a facility at the appointed time. It may be a problem of the operator not being able to comply for technical reasons, a physical security problem, or a safety matter. These inconveniences have not really affected credibility, however.

- In some — fortunately limited — cases, designation of inspectors has proved to be a problem. States have refused to accept categories of inspectors based on linguistic, national or non-proliferation policy considerations. This affects primarily the efficiency of Agency operations, but it also can result in delay of the initial implementation of routine inspections, leading to problems for safeguards credibility.

- Unannounced inspections have proved to be a problem because of the need for access to a country on short notice, let alone no notice, and the requirement in many cases to apply for a visa to secure such entry. Once inside a country, there still can be problems gaining access to facilities for reasons mentioned earlier — safety, physical security, a

requirement that the inspector be accompanied by a national official who may not be available on instant notice, etc. The first problem (entry into a country) can be resolved by field offices such as exist in Japan and Canada; the second problem, cannot.

- A special regime has been developed for limited frequency unannounced access to centrifuge enrichment plants with a defined separative work capacity (one million separative work units a year). Limited frequency unannounced access applies to the cascade area which contains sensitive information. The system operates on the basis of a specified number of inspections on short term (measured in hours) access.

All of this points toward an important concept: *co-operation*. We tend to think of verification in terms of two ideal types: *co-operative* and *adversarial*, with IAEA representing the former (with the objective of building confidence by providing assurance of compliance) and INF the latter. But in actual fact, there must be some of each quality in the other — co-operation in an adversarial situation, and adversarial dimensions to a co-operative approach.

Independent verification provides an adversarial dimension in the case of IAEA safeguards. The inspector makes the choices of what will be verified and when. The operator's reports are used as a baseline, but the inspector's own instrumentation and measurements will ensure satisfaction as to the quantity and quality of material subject to safeguards that can be accounted for. Co-operation is necessary for the system to work — the task of confidence building is surely more difficult without it.

Co-operation does not mean acquiescence; it means coming to the table with a constructive attitude and approach. The overall experience of IAEA demonstrates that, with political will and a co-operative approach, the verification objective can be accomplished to a degree that provides credibility and earns confidence. Stated differently, safeguards that are both acceptable and effective can be developed and deployed and contribute meaningfully to arms control if states are politically ready and willing to ensure their success.

5.3. The Practice of Verification and Personnel Considerations

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Background

It has become an internationally accepted truth that agreements in the area of disarmament or arms limitation must provide means of monitoring that all parties comply with its terms. States will not voluntarily limit or divest themselves of specific means of warfare unless doing so serves their national security, and they will consider it prudent to continue their adherence to such agreements only if they can be sure that all concerned are in full compliance.

The process followed to ensure that all parties to an agreement meet their treaty obligations is customarily referred to as "verification": literally, to make sure of the truth. But verification goes beyond mere fact-finding. With respect to the parties to which the process is applied, verfication should help ensure that they behave the way they have committed themselves to behave and it should serve to prevent them from breaking that commitment. The other parties in turn should derive from the process the confidence that their treaty partners adhere to the rules or that they will have timely warning of an act of non-compliance, so that if necessary they can react appropriately. Since all parties to the agreement are subject to the verification process, these elements of deterrence, of confidence-building and of timely warning apply to each of them.

All three elements are part of the concept of verification and should be given due attention in the development and establishment of the verification system. They reinforce each other and together add to the viability of the agreement to which they pertain. The form and nature of the verification measures to be applied obviously vary with the purposes of the agreement. Monitoring the abolition of a range of existing weapons calls for other means than are involved in the verification of a nuclear test ban or of a prohibition on the production of specific toxic substances that might or might not be used for military purposes.

Verification is treaty-specific. But any system of monitoring the compliance with a measure of disarmament or arms limitation is meant to serve the security of the parties who divest themselves, or forego the production, of the means

of warfare concerned. States, which do not have such means, obtain through the verification process the confidence that permits them to refrain from obtaining them or acquiring alternative means of defence. For the disarmers, verification is a vital element of security. For the non-armers, it is principally a confidence-building factor that helps them stay unarmed.

Obviously, then, multilateral agreements on disarmament or arms limitation call for international means of verification. For parties to accept those means as credible, they have to be devised, deployed, managed and implemented *by* those parties or on their joint behalf. Furthermore, they have to be effective, and seen to be such, no matter what technological problems this may pose. Last, but not least, they must be tolerable to the parties subject to them, and practicable from the point of view of the entity applying them: not so esoteric as to be out of the reach of a relatively well-trained and equipped monitoring body, not too intrusive and, most important, not too expensive.

This combination of apparently irreconcilable demands faces any international verification exercise, whether carried out by an established or an ad hoc organization. Verification is basically a rather "unpopular" exercise. Although recognized as necessary, it tends to be resented for its intrusion into matters that, hitherto, were closed to scrutiny by outsiders, let alone foreigners. Consequently, there is often an element of confrontation in relations between the verifier and the subject of verification. That is regrettable, the more so since the process is in the interest of the latter as much as that of the other parties to the agreement involved. The resentment is psychologically understandable, however. Invested with the ultimate sovereignty over its own affairs, the nation-state has traditionally been solely responsible for its actions, accountable to none. The fact that states must now accept the existence of an authority besides their own that looks at some of their actions to ascertain if they conform with a given international norm, is a fundamental departure from the concept of absolute state sovereignty, and as such, an entirely new concept in inter-state relations. Small wonder, then, that it is not always easy for states (as it is not always easy for the operators of plants that have to put up with intrusions by outsiders), to accept verification and that, once verification has been accepted as a fact of life, they will do what they can to restrict its intrusiveness to a minimum.[1]

Any verifying authority must be prepared to deal with this fact — understanding it on the one hand, but, ready to resist it on the other. And while it concerns on-the-spot verification in particular, it also pertains to other means of verification. In nuclear safeguards, for example, the system is largely concerned with materials accounting, by means of movement, inventory and operating reports, and the verification of designs, instrumentation and

records. A chemical weapons ban will presumably be concerned primarily with (non-) production of certain materials and its verification system may to some extent be analogous to its nuclear forerunner. Inspection is the aspect of verification that is likely to raise most resistance and is most in the limelight. But compliance with sometimes onerous requirements of reporting and record keeping may also raise practical questions, e.g., promptness of reporting and accuracy of record keeping, or conformity with agreed guidelines.

International arms control and disarmament verification is an extremely difficult art. As there are few precedents, it is important to make the best possible use of the limited amount of experience that is at hand. The observations made in this paper derive from developments beginning in the early Sixties, when the IAEA first elaborated a simple set of safeguards measures with respect to research reactors, up to the present, when the Agency's safeguards extend to all stages of the nuclear fuel cycle, including installations handling large amounts of fissionable material in bulk form. This paper attempts to project onto the wider screen of multilateral disarmament verification, some of the lessons learned in a quarter of a century in developing a technically feasible and effective safeguards systems; in devising and negotiating the diplomatic agreements and administrative arrangements that underlie the deployment of that system; and in the system's practical implementation, both in the states concerned and at headquarters.

The lessons to be learned from the Agency's experience may not all be directly applicable to other situations.[2] The IAEA's situation was unique in several respects. Thus, for instance, by the time it was called upon to elaborate and deploy a verification system in respect of important arms limitation measures like the Non-Proliferation Treaty (NPT) of 1968, and the Treaty on the Denuclearization of Latin America (the Treaty of Tlatelolco) of 1967, it had been in existence for a decade and had an active secretariat, alert to the new questions to be dealt with and ready to act as the senior cadre for a newly expanding staff. Besides giving the Agency a priceless advantage in terms of time gained, the fact that the new function was housed in an existing administrative entity inevitably put its stamp on the organizational and logistical approaches that were adopted.[3]

There are several people at this meeting who are far better qualified than I am to speak about the technical aspects of the Agency's safeguards. There are others better informed on the verification aspects of a chemical weapons ban and in a position to judge how Agency verification techniques might be applied. Again, others are well aware of the political and legal issues involved in the imposition and application of the Agency's safeguards. My interests in this context are focussed on the nitty-gritty of experience gained in the IAEA, in helping to develop a technically feasible and effective safeguards

system; to work out and negotiate the legal instruments, technical understandings and administrative arrangements which underlie the deployment of that system; to get the system underway and administer its practical implementation at headquarters and in the field. Several of the lessons learned in that activity would seem to lend themselves to projection on a larger screen of verification of compliance with disarmament agreements.

As noted, verification is treaty-specific. Even though a Comprehensive Ban on the Development, Manufacture and Stockpiling of Chemical Weapons may seem to have a great deal in common with, for instance, the Treaty on the Non-Proliferation of Nuclear Weapons — compliance with which is monitored by the IAEA's safeguards — the technical and commercial factors prevailing in the chemical industry may disqualify many of the methods used in the verification system of a CW ban. But the rather limited and focussed experiences gained so far in the application of nuclear safeguards do show a range of elements that can readily be extrapolated onto other disarmament measures.

It is obviousiy not possible to deal with all the issues likely to arise in devising and deploying a new set of verification measures and in the creation of the necessary organizational base for that deployment. My paper highlights only a few aspects of the subject. In particular, no attempt is made here to sketch a coherent picture of the type of organization that might be involved. Inevitably, that organization will be a highly complicated structure having many technical, political and administrative components, ingeniously conceived to serve its purpose to best effect but always constrained in practice by political reality, economic limitations and bureaucratic expediency. Given the many variables that figure in the development of any international verification system, attempting to predict the administrative and institutional detail of such a system would involve much speculation. But if there is a single immutable lesson to be drawn from one's experience in a world of political uncertainties, it is that in order to be viable, an international verification system must not only be equipped with the technical means to ensure that the provisions of the pertinent agreement are complied with; it should also be endowed with a high degree of immunity to the many factors that will work against its efficacy. This immunity can exist only if the system has good people to run it, and the right structural framework.

Until recently, the practical side of the monitoring process appears to have been virtually ignored in favour of the political issues and the technical problems. There now seems to be a growing, albeit still sporadic, interest in some of the working details of verification. In this context, I shall focus on two aspects: on the legal basis for the specific verification procedures to be applied, and on the question of staff and its management. I shall add some further comments as well on the verification body.

The Legal Basis

Verification is, by nature, a highly technical process. It is difficult to specify in the basic agreement every detail of its implementation. This involves various layers of executive sub-agreements, of which some are important enough to require political agreement between the parties; others may have to be so detailed and specific that it is not practical to include them under the general terms in which any convention, no matter how refined, will be couched. The elaboration of such sub-agreements must be left to the body entrusted with the verification task and will become a subject of individual negotiation between that body and each of the states involved. This brings the risk that the implementation of the verification function varies from state to state and from situation to situation, but it is essential to avoid any such dissimilarity in treatment.

The Treaty on the Non-Proliferation of Nuclear Weapons is a case in point. The *Treaty* itself does not contain verification provisions, it merely obliges non-nuclear-weapon states party to it to conclude agreements with the IAEA (the international body singled out in the Treaty to apply the required verification measures) and it lays down general principles on the purpose of verification measures ("safeguards") to be applied, the items to which they shall apply and the manner in which they are to be implemented. The *IAEA's Statute* empowers that body to apply safeguards and indicates what they shall consist of; it also sets out sanctions for non-compliance with a safeguards agreement. This is not enough: in order to be able to fulfil the verification function allotted to it in the NPT, the Agency has had to develop a *standard safeguards agreement*, which contains the major provision of the system of safeguards applied by the Agency with respect to the nuclear activities of each of the parties.

In fact, the safeguards verification exercise works on the basis of a four-tiered system of agreements and understandings. The Treaty contains the basic layer of obligations; the standard safeguards agreement is layer number two. But detailed though it may be, the safeguards agreement cannot contain the many administrative and technical rules which determine precisely how the respective rights and obligations of the state and the Agency are realized. Those rules, which pertain to all safeguards operations in the state, are laid down in so-called *subsidiary arrangements*. These prescribe, for instance, the nature and frequency of the state's periodic material accountancy reports and the way in which the Agency shall carry out its inventories of various categories of nuclear material. Even this is not enough. On top of this third layer of largely logistical understanding, there is a fourth level of agreement: the *facility attachment*, which is concluded for each of the installations under safeguards, and which specifies the precise safeguards

procedures to be applied, given the exact technical nature and peculiarities of the plant in question.

Obviously, to avoid anomalies and inequities in the application of this four-tiered system, painstakingly negotiated with each of the parties to the NPT that have nuclear energy programs, the implementing body must make a great effort at uniformity. Experience shows that in such negotiations, each state seeks a most-favored-nation treatment. But states naturally compare notes on the treatment they receive. The obvious result is that any concession made, any weakness shown, any exception granted by the verifying organization will be a precedent for all other similar actions: the moment one state receives favorable treatment, all others demand to be treated the same way. Thus, the verification system is subject to an unremitting process of dilution, which only a strong and relatively autonomous international body can effectively fight. The more politicized the verifying authority, the less effective is the verification.

One notes that the Treaty on the Elimination of Intermediate-Range and Shorter-Range Missiles (the "INF Treaty") includes in a single set of documents the basic obligations of the parties, a description of the way in which those obligations are to be met, detailed provisions for the verification of compliance with the Treaty, as well as rules and procedures for the on-site inspections which are part of the verification system. As far as I know, this is the first time that parties to an arms limitation agreement of this degree of technical complexity have sought to regulate in one layered set of texts not only the way in which they aim to live up to that agreement, but the precise means by which they intend to check on its compliance, down to the tiniest administrative and technical detail.

This approach seems to have both advantages and disadvantages. It must have complicated the negotiations and made the ratification procedure more difficult than it might otherwise have been. On the other hand, it may help prevent some later misunderstanding between the parties on the means of implementing the verification provisions, and it will go far to defeat the arguments of those who have criticized the Treaty on the grounds that it does not make adequate provision for on-site verification. One wonders, however, if even at this level of detail it is possible to provide for all eventualities and one fears that an approach of this kind, which is in any case not certain to prevent all later misunderstandings, may entail a degree of rigidity that could hamper rather than facilitate implementation. Then, again, one should realize that in a bilateral agreement of this type, parties keep each other in balance and are in a position to take countermeasures upon the mere suspicion that the other side is cheating.

Multilateral disarmament conventions may not lend themselves as easily to such an all-at-once approach, if only because the negotiations would

be immensely complicated. Further, it remains to be seen if this approach could be applicable in the case of a ban on the production of certain arms or warfare agents (such as a chemical weapons convention), by providing for the application of measures of verification at production facilities. Most likely in such cases, a multi-tiered system like the one employed by the IAEA pursuant to the NPT, involving the specification of verification practices for each factory, would be unavoidable. It is significant that in the draft agreement (the "rolling text") contained in the latest report to the Conference on Disarmament of the ad hoc Committee on Chemical Weapons, for instance, the same items tend to be left open, which in IAEA practice, remain to be settled *after* the main safeguards agreement has been concluded.[4]

Problems may arise from the fact that the negotiators for the verification organization will meet different negotiating partners at the diverse levels of substance to be discussed. The agreement itself is normally negotiated at ambassadors' level. The subsidiary arrangements are handled by the governmental authority directly involved in the implementation of the agreement. The protagonist in talks about facility attachments is the facility operator. This tends to bring with it a loss of cohesion between the various components that constitute the totality of relations between the verifying body and the state in question. Curiously, negotiations tend to get more difficult as one goes down the line to the entity most directly affected by the exercise and least concerned with the political obligations involved. In other words: the working level, "nuts-and-bolts" part of the negotiations — which in practice is very important, if only for the technical precedents it sets — can be the most difficult. It is also the element that tends to be taken least seriously by those most preoccupied with the conclusion of a politically important basic agreement: the diplomats and politicians who tend to feel that technical considerations are less decisive than political ones and can be safely left for settlement among technical experts. When such technical matters concern basic decisions regarding the verification system and its application, this approach carries great risks. Experience shows that an indifference to technical detail on the part of negotiators may lead in the long run to a lessening of the effectiveness of the verification system.

The establishment of procedures to verify compliance with multilateral agreements for arms limitation or disarmament — on which this paper focusses — may both be easier and more difficult than it is with regard to bilateral agreements. Multilateral agreements like a chemical-weapons ban will probably have many parties. That fact is likely to deter stand-out states from negotiating too unreasonably for far-reaching constraints on verification, lest they lose credibility. But, as I have said before, practice teaches that a concession once granted to one state becomes law as far as all the others are concerned, and if one nation can set itself up as the champion defending all

others against the onslaught of the "big, bad verification wolf" it may well succeed in weakening the procedures beyond a reasonable level. In NPT safeguards practice we have seen how states which are beyond reproach from a nuclear proliferation point of view and strong supporters of arms control may yet be quite capable of forcing the verifying body to accept changes which are liable to harm the integrity and efficacy of its operation significantly. This fact in itself would seem to indicate that the verifying organization will need every bit of political autonomy and strength it can muster.

The Human Side

Verification is not only treaties, systems, methods and instruments, it is also — and perhaps in the first place — people. The human side of verification is all too often overlooked.[5] It is rare that press reports on arms control negotiations acknowledge that, however much one relies on instrumentation and remote-controlled verification methods, it is in the last instance people who man the instruments, analyze the samples and read the computer print-outs. From time to time — and then usually only when something goes wrong — does the human factor peek through, e.g., when the Director General of the IAEA has occasion to complain about the insufficiency of funds which make it difficult to find and keep high quality staff, when countries impede inspectors' access by complicating the designation process,[6] or when some scientist attending a test site is caught exporting soil samples. Sometimes also the media run some "human interest" story about visits by Soviet verification experts on American soil or by American inspectors to the U.S.S.R. Such reports are marginal indications of the important role of human resources in the application of any verification system.

Inspection Management

If it is a basic requirement for the potential efficacy of the verification system that it rely on a solid legal fundament, it is equally important that it should be intelligently applied and managed and that the human resources on which its operation depends should be of first-rate quality.[7] The management of a verification system presumes a level of intellectual and political independence and objectivity which is hard to find in everyday life but which is a *sine qua non* to establish confidence in an international framework.

Inspectors who apply the system in the field should not only be capable of operating independently, often under adverse and disagreeable conditions, but they should be endowed with tact, patience, technical competence, energy and stamina, a gift for languages, courage, honesty and, above all, be convinced of the importance of their jobs. Surprisingly, it is possible to find such people, or it has been so in the past. It is an open

question, however, how long it will remain possible to find them and especially whether, with several agreements in place requiring verification and a growing number of installations to be inspected, one will be able to find the large number of people needed for the job — not only now, but in the indefinite future.

The present international civil servant — once considered a privileged figure — has come to realize that international life may hold more disadvantages than does the easier existence of the national bureaucrat or the industrial employee whose remuneration grows with performance. Nuclear industry is going through a slump and for the moment the job of nuclear inspector may offer some rewards hard to find in private life. This does not apply to the same degree for the chemical industry, for instance; and to be capable of acting as an inspector under a treaty banning the production of chemical warfare agents, a person must command a level of expertise likely to be more highly rewarded in private industry than in an international organization. Moreover, the work in that international organization may be less interesting and career prospects uncertain — not to dwell on the problems associated with life in a foreign country: problems of schooling, housing, language and many more, among which often the most important is that of the working spouse unable to find a suitable occupation abroad.

This leads right away to two conclusions. First, any verification body should be in a position to offer candidates for inspectors' jobs good employment conditions. And second, the inspection task should be so circumscribed that it can be carried out by persons of average intelligence and training. The latter will be a function of careful development and prudent management. The inspector should be instructed as to precisely what data should be obtained and how, and the system should be designed to make this data gathering relatively easy. To the fullest extent possible — and this is a third and fundamental conclusion — data should be interpreted by a managerial apparatus responsive to very high demands for objectivity and technical competence and endowed with a great measure of functional independence in its analytical tasks. These requirements are well illustrated in various working documents generated in various sub-groups of the CD, which reflect the importance the negotiators in Geneva attach to this aspect of verification. But, while such negotiations should set the stage for the establishment of a verification body and give this body all the power it needs to work, the efficacy of its operation is determined by the quality of the people running it. In the last instance, the viability and credibility of a verification organization will depend on the quality of the personnel it can attract.

But verification is not based exclusively, or even primarily, on on-site inspection and the analysis of its results. Where production processes for bulk

materials such as chemicals or nuclear substances are involved, an over-all analysis of compliance must take account, *inter alia*, of the characteristics of the installations covered, as reflected in: the design information to be presented; the results of checks on quantitative and qualitative bookkeeping data with respect to the material produced, received and shipped out; investigations of plant management's records on transfers and receipts; and of any potentially relevant incident. Among the various aspects of verification, inspection is only one of many jobs, albeit usually the most visible and often the most difficult one. The managerial and analytical functions involved go far beyond the complexities engendered by on-site inspection.

Organization

The international verification function presumes the existence of a competent and well-equipped organizational entity to serve as its base of operations. On political and practical grounds, it may be desirable (or unavoidable) that a future organization established to monitor compliance with multilateral arms control agreements should be associated with an existing multilateral institution. For the sake of efficiency and technical autonomy it is very important that the organization should not be subsidiary to the body with which it is so associated. It may be recalled that the IAEA, which reports annually to the UN General Assembly, is not subsidiary to the United Nations. It is an autonomous body — neither a specialized agency nor a branch of the United Nations. To retain its autonomy, any verification organization should be conceived so as to avoid the veto of a superior political organ, the irrelevance of a multilateral gathering preoccupied with political utterances and the infiltrations of its governing organs and of its secretariat by considerations, practices and processes not immediately germane to its technical purposes and its practical operation. It should be exclusively concerned with the technical and logistical aspects of verification and the analysis of the data obtained, and be free to function with a minimum of political disturbance.[8]

If the international community decides to create one body for the verification of compliance with several multilateral measures of arms limitation or disarmament, it would seem appropriate that each area of verification should be funded separately by the parties to the agreement; only general overhead costs would be common items, and the overall supervision of its management might be entrusted to an executive council that could take its decisions either by consensus or through a process of weighted voting, based on each state's involvement in various arms control measures under its jurisdiction. The organization could report to the multilateral negotiating and deliberating bodies directly involved, but it should derive its mandates only from the pertinent agreements and from review or other relevant conferences.

A "Shopping List" of Issues to be Selected

In summary, it may be useful to place the foregoing statements in the form of a "shopping list" of issues to be settled. Each point requires detailed consideration. It is not the intention of this paper to do more than note some items that come to mind in a quick overview.

Under the heading "Legal Basis" some of the more obvious points to be kept in mind are:

- the question whether the agreement should regulate all details (as does INF) or should leave the settlement of the details of implementation for later negotiation (as in the case of the NPT).

- following from the above: how are later implementation details to be negotiated; at what level or levels?

- how does one cope with the demand for most-favored-nation treatment versus the need for uniformity and non-discrimination, while keeping in mind the need to maintain effectiveness?

- in the search for uniformity, if one set of negotiations results in a deviation from an earlier established norm, how should that deviation be fitted retroactively into older arrangements?

- how are changes resulting from altered verification approaches incorporated into existing agreements and/or arrangements?

- at what level of codification and negotiation are arrangements made for (as examples) the following measures:

  — emplacement of instruments;
  — free import and export of instrumentation;
  — access to installations/time and form of notice;
  — export of samples/transport rules;
  — diplomatic privileges for inspectors/pouch rights;
  — inviolable means of communication; and
  — designations of inspecting personnel/passports/visas.

With regard to the "human factor", the following issues come to mind:

- how does recruitment take place: through governments, advertisements, recruitment missions to industrial centres, universities . . .?

- what are the requirements/qualifications of personnel?
- employment conditions: remuneration, length of employment, career prospects;
- the question of relations with the home country: home country support on recruitment, career advancement?
- continuing ties to facilitate return versus independence from the home country without the expectation of jobs on return;
- family questions: schooling; jobs for spouses; measures to cope with consequences of changes in duty station.

The question of the organization covers the requirements of management as well as the body to be used or set up for the purpose. Under "Management" (in particular, "personnel management"), some important points are:

- the lines of command for verification findings;
- the degree of independence of the inspector with respect to his/her immediate supervisor(s);
- rewards for competence and reactions to inadequate performance;
- independence (from national ties), which means reacting to infringements of the obligations of the international civil servant.

The organization is more than an administrative apparatus and a body that deals with member states. Under the heading of "Organization" one also has to think of subjects like:

- the establishment and operation of analytical facilities; means to ensure anonymity of samples; procedures of gathering, distributing and safekeeping of samples; rules for their despatch; tamper-proofing of facilities and containers[9];
- the use of collected data;
- independence of the organization; its autonomy in action;
- accountability: what for, when, to whom;
- means of avoiding "politicization";
- source(s) of income; the budget process.

Earlier, mention was made of the relative advantage at which the IAEA found itself when called upon to devise a safeguards system to be applied pursuant to the NPT, given the experience already gained in applying the older system and the availability of a skeleton staff and an administrative infrastructure. This situation was unique. In the case of a chemical weapons convention, preparations will have to start from scratch and early action is essential.

The "shopping list" must include items such as early recruitment of expert cadres, preferably even *before* the institution itself is set up. This conundrum might be approached along the lines of the "preparatory committees" that are created to prepare for review conferences of arms control agreements, well before the conference itself can vote the funds and set the terms of reference for the exercise. In the case of a CWC, an appeal for assistance might be made to the Secretary-General of the United Nations, *via* a resolution of the General Assembly. Meetings such as the present one, of essentially non-governmental groups in which responsible government officials participate, can have a seminal part in the preparations.

Some General Comments

Multilateral verification of arms control agreements is a new phenomenon in international affairs. It is a novelty not only because it has introduced technical complexities which few diplomats have been equipped traditionally to handle, but because it represents a fundamental departure from the principle of sovereignty of nation-states. International verification implies the involvement of the world community in the affairs of the individual state. No matter how hard a state is determined to live up to its international obligations, it will tend to find it politically and psychologically difficult to accept the concept that, under most arms control agreements, it must prove its innocence to be believed. It is all the more difficult for the state to have to supply part of this proof by submitting to the alien intrusion inherent in most verification systems.

The structure of the verification agency must reflect this reality and be responsive to it. It must be able to carry out a highly complicated technical task under difficult political and practical conditions. It must meet unique organizational and managerial requirements in the way it is set up, and it must operate at a level of technical competence high enough to permit the international community to give full credence to its findings. Above all, it must have the right people and the means to attract and keep them and make the best use of them.

There is no need to point out the importance of disarmament and arms limitation in international security. Verification is generally recognized as an essential element in present-day disarmament measures. The logistical and

administrative problems involved in the establishment of a viable and convincing system of verification are less widely known. Many of those problems are so down-to-earth as to appear too pedestrian and trivial for serious consideration in deliberations dealing with subjects of immediate significance for the security of the parties involved.

The practical and pedestrian aspects of verification must be faced, lest the system be unable to operate effectively and thus frustrate the very purpose of the disarmament agreement it is meant to support. There is an old fable about cause and effect, from the trivial to the important: starting with the loss of a nail, *via* the resulting casting of a horseshoe, causing the horse to go lame which prevents the rider from delivering his message in time so that the army's commander lacks the data that should have helped him win the battle — and eventually leading to the fall of an entire kingdom. It should not be said that a lack of readiness to deal with the apparent trivia of verification practice prevented effective disarmament — at the eventual expense of world peace and security.

Notes

1. This is one of the basic provisions of the standard agreement text ("The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons"; IAEA document INFCIRC/153; the so-called Blue Book) of which para. 4(b) states that safeguards shall be implemented in a manner designed to "avoid undue interference in the State's peaceful nuclear activities and in particular in the operation of facilities."
2. A useful description of both possible parallels and obvious differences is given by Bas ter Haar and Piet de Klerk: "Verification of Non-Production: Chemical Weapons and Nuclear Weapons Compared." in *Arms Control*, Volume 8, Number 3, December 1987.
3. For an excellent critique of the history of IAEA safeguards, see *inter alia* David Fischer and Paul Szasz (Jozef Goldblat, Editor): "Safeguarding the Atom: A Critical Appraisal," Stockholm International Peace Institute, Taylor & Francis, 1985.
4. The most recent version is contained in document CD/874 of 12 September 1988.
5. Except by insiders! See, for instance, Adolf von Baeckmann, *The Chemical Weapons Convention and Some IAEA Experiences*, reprinted in these proceedings.
6. It is an old story that some states follow a practice of complicating the designation process as much as possible. Already in 1970, a senior member of the Agency's legal staff noted that some states used the consultations that precede inspectors' designations "not only to weed out particular individuals but even entire groups" and he warned that "through the mechanism of selective rejections" states could in effect choose a few persons it was prepared to accept (Paul C. Szasz, *The Law and Practices of the International Atomic Energy Agency*; IAEA Legal Series No. 7). The process of recruiting and designating safeguards inspectors as practiced in the Seventies, and some of the problems encountered in its practice, are briefly described in Ben Sanders, "Safeguards Against Nuclear Proliferation," A SIPRI Monograph, The MIT Press Cambridge, MA and London, England, 1975. This advocated a practice of appointing as many inspectors as possible for any given state, so that the Agency would have greater flexibility in assigning personnel. Member states have

Notes cont'd.

long resisted suggestions to this effect and it is worth noting that the Soviet Union is among the few states ready to accept the practice, having announced at the 32nd General Conference of the IAEA, in September 1988, that it is ready to receive all Agency inspectors from countries with which the U.S.S.R. maintains diplomatic relations.

7. See: von Baeckmann, Op. cit.

8. For an excellent description of the functioning of the IAEA, especially in the field of safeguards, see Lawrence Scheinman, *The International Atomic Energy Agency and World Nuclear Order*, Resources for the Future, 1987. The remarks made in this book on the actual and potential "politicization" of the IAEA apply to any "technical" multilateral organization and should be read by anyone concerned with the creation of an international organization for the verification of disarmament agreements.

9. Some of these points are dealt with very well in von Baeckmann, Op. cit.

Chapter 6. The IAEA and the Process of Technological Change

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I have been asked to talk about the IAEA and technological change. This is a subject that allows a speaker to present any preconceived notion in the area of arms control and, yet, not to deviate much from the main topic. One can speak *ex cathedra* and very quickly descend to arrogance, or one can provide a multitude of well documented details and, equally quickly, lapse into triviality and irrelevance. To avoid either trap we must establish some points of reference.

The Nature of the Beast

Technological change does not occur in a vacuum; it requires an environment conducive to such changes. If we look around us, this environment is generated by the confluence of educational, economic, social and political conditions.

The actors, those who advance technology and those who use it, are engaged in a closed circular dance, constantly pushing each other; they provide feedback from innovator to user and *vice versa*. More dynamic environments foster faster changes.

Let us now look at the IAEA and see if we can find a place for it in such an environment. Then, we might be able to understand how the IAEA deals with technological changes.

In simple terms, the IAEA has two roles: to monitor the nuclear fuel cycle, and to foster peaceful use of nuclear energy. I will concentrate my remarks on the monitoring role. The IAEA views itself not as a policeman but as an alerting agent.[1] It has established a system of international safeguards that indicate anomalies anywhere in the fuel cycle. The safeguards system revolves around the principle of materials balance. Safeguards are designed to detect and deter diversion of material from the fuel cycle.

The two major components of the safeguards system are inspections, and data reporting, management and evaluation. I will, therefore, address

technological changes and their impact on these two major components. However, this issue cannot be fully explored without factoring in the nature of the IAEA as an international organization.

The IAEA is an organization existing by agreement among sovereign states; it operates through contributions from these states; it can request support but it cannot demand it. Unlike competing interests within a state, the IAEA cannot make a case for the "value" of its services to the authorities who appropriate funds; the IAEA is an agent of nations pursuing global social benefit. Also, unlike other providers of services, the IAEA is not subject to the impact of market forces that assign value to those services and provide some resemblance of control to the escalation of costs. The only inputs to which the IAEA reacts are provided through the political judgment of the member states.

In addition to the international political constraints, there is the composition of the staff. Appointments to positions are governed, in the most charitable characterization, equally by political and professional considerations. The higher the position, the more dominant the political considerations become; the Director General can be a citizen, in reality, of only a few, certain countries.

Finally, access by the IAEA to a facility is provided through agreements between the IAEA and the state, or the IAEA and EURATOM. In this link, the facility operator has, at least officially, an indirect role; yet, the operator is the primary subject of monitoring.

From the perspective I have just discussed, the IAEA is constrained to operate in the static environment dictated by the terms of the Non-Proliferation Treaty. It has been designed to operate in a political arena which is detrimental to innovation, yet it is asked to do a monitoring job of immense magnitude and complexity. Ironically, the IAEA would be an ideal testing ground for some of the latest technological innovations in sensors, communications, computers and systems concepts. In its present incarnation it may not and it cannot become such a testing ground; such is the nature of the beast.

The Role of Technology

The IAEA is supposed to collect, process and evaluate information in the global environment; it is supposed to detect anomalies and generate alerts in a timely manner. Technology has already solved this problem. The combination of computers and communications has linked most of the world into a huge information-processing system. Publishing, banking and other financial institutions, as well as universities and research centers are all routinely exchanging information across borders. Yet, the inspection concept of the IAEA, and *the*

current thinking about Chemical Weapons Treaty inspections, are premised on travelling inspectors carrying suitcases with instruments!

Let us look at some specific examples. We will discuss what it is and what it could be; we will also try to postulate why it is not.

One of the roles of the inspection regime is surveillance. It is supposed to provide continuity of coverage between inspection visits at certain places. Since the Seventies, surveillance has been provided by 16-mm movie cameras triggered by a timer. A pair of these cameras is installed in a container made of continuously cast aluminium with a glass viewing door on one side. The door is bolted closed and then sealed with wire seals by the inspector. The container and the seals render the assembly tamper-resistant. The only external connections are cables for electric power.

The cameras are triggered, on the average, once every 20 minutes. In this operating mode, the film cassettes last about three months. In power reactor facilities, an inspection visit is scheduled every three months, primarily, to retrieve and replace film cassettes. During the visits the inspector might perform other duties; however, the determining factor for this particular scheduling of inspections has been the technological limitation of the surveillance system. Incidently, refueling of the power reactors, which makes a more compelling argument for the presence of inspectors, does not occur more frequently than, at least, once a year.

The 16-mm movie cameras are slowly being replaced. Why? Not because something better has been found, but because 16-mm movie cameras have become obsolete and they are being discontinued by the manufacturers!

Before we look at the new surveillance technology being introduced into international safeguards, let us take a small detour into the world of image-processing technology. We will start with the sensors. Lenses and optics dominated the sensing stage of image processing. Light, passing through lenses, interacted with the chemicals on the film to produce images. That was the end of the road for the information-carrying light beam. Along came electronics; it was paired with optics, and television was created. Currently, sensing of light beams is done directly by electronics, in the form of photo diodes and charge-coupled-devices (CCD).

Consider the storing of images. The conversion of optical information into electronic signals gave rise to magnetic recording on tapes. The signals are inherently analog, and the recording was also in analog form. With the advent of photo diodes, charge-coupled-devices, and high-speed and high-accuracy analog-to-digital converters, the images are coverted into numbers. These

developments have given rise to digital tapes, digital discs and digital still-picture cameras.

The digitization of images has brought the power of computers to the analysis of images. A computer can examine a picture frame, look for specific information in images and discriminate between images. In the manufacture of component parts, quality control is performed by imaging systems coupled with computers. The computer knows that, if a part does not conform to certain parameters, stereometric or others, it must be rejected; the computer automatically triggers appropriate actions at the next step of the assembly line. Humans are absent from the loop.

Another significant impact of electronics, however, has been in the shrinking of distances. We receive images from the fringes of our planetary system, we process them and we produce high-resolution pictures of objects which are millions of kilometres away. In more terrestrial applications, we can send pictures through telephone lines in less than one minute per picture. The equipment in the commercial market costs less than US$10 000. Surveillance could be done remotely, in real time. Yet, in monitoring arms control agreements, we sent inspectors to retrieve film cassettes.

Let us now return to the "new" surveillance technology for safeguards. The first candidate designed to replace the film camera system was the Surveillance Television and Recording System (STAR) developed by Sandia National Laboratories.[2] It uses two television cameras; images are recorded on cassettes, using two redundant video recorders. It has the capacity to record 26 000 scenes, which is equivalent to one year's recording of images taken once every 20 minutes. In effect, it eliminates the need for quarterly visits to power reactor facilities.

The system is self-contained, computer-controlled, and it is designed to operate unattended. It also allows an inspector to review the tape on-site. Approximately 20 of these systems have been built; 13 are deployed; it is not clear if any more will be built. Cost per system? About US$60 000.[1] Cost of commercially available video recording systems? Less than US$5 000.

A second-generation video surveillance and recording system has also been developed by Sandia.[2] It is called Modular Integrated Video System (MIVS); it is supposed to be a more reliable and more versatile version of STAR. In the final analysis, however, it has the capacity of recording up to 26 000 scenes; the same as the STAR. I do not have cost figures but I understand it is supposed to cost less than the STAR.

In Japan, at the Tokai Research Establishment of the Japan Atomic Energy Research Institute (JAERI), a parallel but belated development effort has resulted in the Compact Surveillance Monitoring System (COSMOS).[3] It also has been designed to replace the original film camera systems. The basic principle is the same as that of the STAR and MIVS: a self-contained video recording system. The scene capacity is a little better; it can store 50 000 scenes which are equivalent to three months' worth of surveillance with pictures taken at five-minute intervals.

Yet another video surveillance recording system has been developed in Canada in conjunction with the CANDU safeguards system. At least four *incompatible* surveillance systems for a few hundred facilities! These systems use state-of-the-art components: CCD cameras, 8-mm recorders, the latest microprocessors. One then might say that the IAEA is in the midst and in the forefront of technological change. But, is the technology relevant? Are the systems state-of-the-art? Which one of us could stand to review 26 000 frames without being blinded, bored or made crazy?

There has been a proposed solution: a film scanner to automatically detect changes in sequential scenes. If changes in certain scene parameters occur, the scanner flags the scene sequence for further optical examination by the inspectors. The first version of the scanner was not used; the inspectors did not like it; it was considered too noisy.[1] It is my understanding that work still continues on the development of automatic scanners! In the meantime, there are computer programs which routinely analyze, improve, and modify pictures. The latest innovation in this field comes from Japan: a three-dimensional, integrated-circuit, image processor; it processes a single frame of an image in microseconds.

The second major component of the safeguards system involves data management and data evaluation. The sources of data are the states and the inspectors. It would be of particular interest to follow the trail of data generated by inspectors. During an inspection certain tasks are performed by the inspector and appropriate data are generated. Forms are to be filled. Theoretically, these forms should be filled when the observations, measurements or calculations are made; in practice it is not always so. The forms are transported to the IAEA headquarters; eventually, they are transcribed into computers. The complete database is used to ascertain whether or not there has been a diversion. The process takes months to complete.

By way of contrast, one can call an airline office somewhere in Europe and, within a few minutes, reserve a seat on a flight of another airline in the American continent or in Asia. Also, within minutes, an insurance agent in a field office can have access to his customer's records from headquarters

thousands of kilometres away. A company can monitor the performance of its plants half-way around the globe. A newspaper can collect material from field correspondents, compose an edition at headquarters, print it in satellite plants around the world — all of these within a 24-hour period. Optical scanners routinely transcribe forms into computer-readable formats for introduction into local or remote data bases. Yet, inspectors carry handwritten reports to Vienna.

For years, there has been talk about near-real-time accounting techniques, and process monitoring. Today, the talk is still about future implementation.[4]

Of course, there have been successful incorporations of technology into the safeguards system. All the successes involve specific instruments for specialized applications. In particular, when a *well-defined need* unique to international safeguards has been identified, instruments have been developed by the various national support programs and are being used by the IAEA.

Some Causes of the Problem

Should the IAEA be blamed? Definitely not. The IAEA is a creature made primarily for political purposes. It does not require a hardened cynic to smile at the "voluntary" offers of the established nuclear powers to place some of the civilian nuclear facilities under international safeguards. What kind of incentive would drive people to become innovators in the use of technology? For what purpose? Just political showmanship?

The political dimension permeates all aspects of the operations of the IAEA; it works to the detriment of innovation. To begin with, the IAEA has no credible development effort of its own. It devotes the bulk of its regular operating budget for safeguards to the inspection effort. Its benefactors judge its performance by the number of effective inspection person-days per year. The IAEA knows what it must do!

How are new technologies introduced? Primarily through the various national technical assistance programs. Naturally, each of these programs is designed to serve the corresponding national objectives. Is there substantive co-ordination among the programs? No.

Although I am not very familiar with the details of the various support programs, these programs seem to operate in conjunction with perceived national interests. They are not meant to and they cannot reflect an international interest. My remarks will be based primarily on the workings of the U.S. Support Program. In addition to the various national perspectives and the lack of co-ordination among the respective support programs, the internal structure of these programs and their relationship to the IAEA do not facilitate the transfer of technology.

First, the IAEA, with no development effort of its own, lacks the technical competence either to keep abreast of, or to absorb the latest developments in technology. Second, because of the pressure of the inspection goals, the IAEA places high priority on items of immediate need when it requests technical support. The support structure does not allow for experimentation and risk-taking, which are *sine qua non* for innovation. Third, the support programs do not allow the IAEA to solicit ideas and technology from the world market; funds must be spent primarily in the country that is supplying them. Fourth, the support programs disbursing funds exclude competition; the funding authorities are no more than recycling agents transferring government funds into government laboratories. Even among the laboratories there is no competition. This mechanism inhibits the introduction of new technologies into the operating mode of the IAEA. I do not mean to imply that there is no innovation in the laboratories. On the contrary, some of the most significant and innovative ideas have been generated in universities and in government and private laboratories. However, the transition of these discoveries into viable and usable products has always occurred under the stimulus of risk-taking; in the case of some specialized technologies, such as defence, transition occurs by a funding mechanism that does not assign high priority to the cost. Corollary to the last structural defect, the providers of new technologies through these programs, although they might be highly competent professionals in their own right, have no incentive to be innovative. There is no market to evaluate their products; there is no feedback, no circular dance, which is essential in engineering, to help bring out the best in the designers.

Lessons to be Learned

It is apparent from the foregoing that the IAEA cannot deal easily with rapid technological changes. Even when new nuclear technologies are introduced, it must rely on the technical expertise of the member states which are generating the technology. The rate of transfer of such technology depends on the willingness of the states to transfer it and the political priority they attach to such transfers. To the question then of "How does the IAEA deal with technological changes?", the simple answer is: "as it is allowed to."

Can the situation change? Not likely. There is a treaty that has established the operating constraints of the IAEA. There is an established international bureaucracy in place. There are associated national bureaucracies. There are vested political interests, both national and international, in the status quo. Any attempts at radical solutions will be vehemently opposed by both friends and foes of the IAEA. In the meantime, the IAEA will probably be increasing the number of effective inspection person-days per year, it will be certifying non-diversion for the states which allow inspection, and it will not be deterring the acquisition of nuclear weapons by the states which are determined to have them.

However, the IAEA can become a very useful model for a Chemical Weapons Treaty. The IAEA has correctly perceived itself as an alerting agent in the international community; anomalies must be detected and announced in a timely manner. In effect, the IAEA is a monitoring agency; it needs appropriate monitoring tools. To date, the primary monitoring tool has been the inspection. Whether by design or by accident, the monitoring operation revolves around and emphasizes the presence of inspectors in some places and at particular times. Therefore, the development of the technology has been strongly influenced by the dogma that monitoring is performed through inspections. This dogma is the foundation of the theology of effective inspections; inspection is the deity and the world of monitoring revolves around this supreme entity.

In the meantime, distances have shrunk and time has sped up. We see places without travelling, we detect events within fractions of a second from their occurrence, we control activities from great distances. It is time to introduce new concepts; a new dogma is long overdue. For the Chemical Weapons Treaty, the principle should not be "inspections" but "monitoring." Under this new dogma, the primary function of an international verification organization would be the monitoring of all activities under the purview of the treaty. Of course, monitoring is performed through data collection, data processing and data evaluation. The relevant data are generated by sensors at a facility or near an activity, by remote sensors and by inspectors. Inspection is only one of various data-generating activities; it should be a dispensable activity subordinated, at any given time, to the latest monitoring technology.

The language of the treaty should not stipulate inspections as the means of verification. Instead, it should call for monitoring to be performed through the latest technological means and techniques. The international organization should be structured to seek or develop and should be given the authority to use the latest technology available to perform its duties. Of course, appropriate safeguards should be incorporated to prevent unwarranted intrusion and to protect the confidentiality of proprietary information. These considerations should be some of the design parameters of the monitoring system.

By removing inspections as the focal point of verification and relegating them to their proper role as one of a number of available tools, the new agency would not have its performance judged by the number of effective inspection person-days per year, but by the effectiveness of its monitoring procedures. There would be a greater incentive to automate the process and remove the inspector, as much as possible, from the loop. Under such a scheme, the international authority would have a greater incentive to be innovative.

Technical support programs should not exist in their present form; they cannot provide the latest technology. The Agency should be given a

development budget and it should be expected to manage it. One might even wish to experiment with allowing the agency to procure technology and services in the open international market. Some might express concern about the unrestricted flow of technology and about the loss of political control exercised through the national support programs. The question then becomes: do we want an effective treaty or a political mirage?

Notes

1. "New and Better Equipment Being Made Available for International Nuclear Safeguards," Report No. GA01/NSIAD-84-46, U.S. General Accounting Office, June 14, 1984.
2. Mangin, D.L., "Hardware for Potential Unattended Surveillance and Monitoring Applications," Sandia National Laboratories Report SAND87-2840.UC-13, Albuquerque, New Mexico: January 1988.
3. Mukaiyama, T., *et al.*, "Development of Containment and Surveillance Systems at the Japan Atomic Energy Research Institute (JAERI)," *Nuclear Safeguards Technology 1986*, Vol. 2, IAEA-SM-293-35, Vienna: International Atomic Energy Agency, 1987.
4. Report to the Congress Pursuant to Section 601 of Nuclear Non-Proliferation Act of 1978, for the Year Ending December 31, 1987, Washington, D.C.: January 1988.

Chapter 7. National Infrastructure for Implementing IAEA Safeguards Obligations

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Introduction

Since 1972 the International Atomic Energy Agency (IAEA) has carried out safeguards inspections at nuclear facilities in Canada under an agreement between the IAEA and Canada. The agreement is based on the Agency's document "The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons."[1]

The success of the Agency's activities depends on a high level of co-operation between the Agency, the Atomic Energy Control Board (AECB) and the operators of the facilities using nuclear material. To assure co-operation, a large infrastructure is required involving the AECB and the facility operators.

Atomic Energy of Canada Limited (AECL) is part of this infrastructure in two ways. It operates two research and development facilities, Chalk River Nuclear Laboratories (CRNL) and Whiteshell Nuclear Research Establishment (WNRE). As well, AECL is a partner with the AECB in a program to support IAEA safeguards. The support program activities are independent of the agreement under which the inspection activities are carried out.

This paper outlines the Canadian effort required annually to assist the IAEA in implementing safeguards.

National Infrastructure for Accounting for and Control of Nuclear Materials

Under the agreement between Canada and the Agency, Canada must establish and maintain a state system of accounting for and control of nuclear materials (SSAC). Guidelines for such a system have been issued by the IAEA.[2] The purpose of the SSAC is to provide the infrastructure to supply information and other assistance needed by the Agency to carry out its responsibilities under the agreement. The system exists at two levels, state and facility.

State Level

Legislation and regulations are required to ensure that the obligations undertaken by Canada are met. The legislation designates the Atomic Energy Control Board as the country's nuclear material accounting and control authority. The AECB has the responsibility to:

- establish regulations for possession, transfer (both domestic and international) and use of nuclear materials;
- establish material balance areas in conjunction with the facility operators;
- act as Canada's point of contact with the IAEA on safeguards matters;
- develop, approve and implement appropriate nuclear material accounting and control measures;
- evaluate the information provided by the facilities and prepare reports for the IAEA; and
- ensure the objectives for nuclear material accounting and control are met.

Facility Level

Under the national legislation nuclear facility operators must co-operate with the AECB and the IAEA in implementing safeguards. This imposes a burden and an expense on the facility operators that they might not accept without legislation.

Each facility operator is required to:

- describe its organization responsible for developing and implementing nuclear material accounting and control;
- establish an accounting and control system;
- provide information on design and operation in sufficient detail to permit evaluation of its accounting and control system;
- establish material balance areas and key measurement points;
- establish procedures for flow measurements; and
- establish procedures for physical inventory taking.

Inspections at AECL Research Company

AECL Research Company has nuclear material at both CRNL and WNRE. Table 6 lists the material balance areas (MBAs), five at CRNL and one at WNRE. The larger number at CRNL is a consequence of the larger quantities, greater number of users and greater number of physical locations of nuclear material at CRNL.

Table 6

Material Balance Areas (MBAs) and IAEA Inspection Activities at AECL Research Company

Site	MBA Description	Annual Inspection Activities	
		Interim Inventory Verification	Physical Inventory Verification
CRNL	NRX Reactor	1	2
	NRU Reactor	1	2
	Hot Cells, Shops, Waste Management	3	3
	Unirradiated Material Storages	1	2
	Laboratories	1	2
WNRE	Entire Site	0	2

Note: CRNL is inspected monthly and WNRE quarterly.

The IAEA, AECB and AECL agree on the annual routine inspection schedules before the beginning of each calendar year. CRNL is inspected monthly and WNRE quarterly. An inspection team usually consists of two to five IAEA inspectors accompanied by a representative of the AECB. The number of inspectors and the length of their stay for a visit varies depending on the activities planned. The nuclear material records are examined during every inspection. Typically, an inspection at CRNL involving physical inventory verification (PIV) will require about 20 inspector person days, and an inspection involving only interim verifications will require six to nine person days. At WNRE, with only one MBA, the number of person days is proportionately smaller. In total, the IAEA will spend about 150 person days at CRNL and 16 at WNRE in 1988. The expression "person days" as used herein means one person's time for one normal-length day of work. It does not refer to "man day" as defined in Reference 1.

WNRE has estimated the time required of its staff before, during and after an inspection involving examination of records only and for a PIV. The Agency carries out two of each type of inspection there annually. The estimates, shown in Table 7, indicate a yearly effort of 38 person days for inspections involving 16 IAEA person days, a ratio of 2.4 to 1. Considering the two sites as a whole, a ratio of 2 to 1 is as close as can be estimated without a detailed investigation.

Table 7

Estimated Facility Effort Resulting from IAEA Inspection Activities at WNRE

Activities	WNRE Person Days
Examination of records only	
Activities before, during and after the inspection	2
PIV plus examination of records	
Pre-inspection	
Take inventory	3
Prepare inventory list, update records	1
During inspection	
Accompany and assist inspectors	
Accounting Officer	2
Security Officer	2
Radiation Surveyor	1
Laboratory Staff	3
Reactor Staff	2.5
Equipment Operators	.5
Post-inspection	
Package and ship IAEA's samples	1
Prepare and issue report to AECB for IAEA	1
Total for PIV	17

Inspections at Other Canadian Facilities

In 1987 the total number of IAEA inspection person days in Canada was 1118.[3] These were distributed as follows:

3 natural uranium fuel fabrication plants	50
19 CANDU reactors	864
Other facilities (including AECL)	204

The Douglas Point reactor is permanently shut down. In 1987 its irradiated fuel was transferred to long-term storage in concrete canisters. That activity alone occupied over 500 of the 864 person days for CANDU reactors.

The CANDU 600 operators estimate they spend 1½ person days for each IAEA person day of inspection. The ratio is probably typical for the other CANDU stations.

The way in which PIVs are carried out for certain facilities merits a brief description. The Canadian nuclear fuel cycle involves, at the uranium conversion and fuel fabrication stages, relatively low facility inventory levels as compared to the inter-facility flow rates. There are almost daily shipments from the conversion plant to the fuel fabrication plants. In the early 1980s, the IAEA realized that verification of these transfers to an acceptable confidence level would require about 140 inspections per year.[4] In 1982 the IAEA and the AECB agreed that if the conversion plant, the three fuel fabrication plants and the CANDU reactors could be considered as one "super-MBA," then simultaneous physical inventory verifications (known as SIM-PIV) at all the facilities would avoid the need for a high level of verifications of flow between the facilities.[3,4,5] All the uranium entering safeguards at the conversion plant can be accounted for either there or at the other facilities within the "super-MBA," or by international transfers. The diversion strategy of borrowing material from one facility to make up for a deficit at another facility is defeated by the SIM-PIV.

SIM-PIV has been carried out successfully at the end of July each year since 1983. If, for operational reasons such as a plant shutdown, a facility cannot be inspected at the same time as the others, the IAEA in advance of the SIM-PIV either verifies and seals as much material as possible at the facility, or else simply seals the material for verification after the SIM-PIV.[5]

The Canadian Program of Safeguards Support to the IAEA

The impact of the IAEA's safeguards activities in Canada is not through the SSAC alone. Canada is one of a number of countries that have a program to support the IAEA in its safeguards activities.

It is a policy of the government of Canada that the export of nuclear material, facilities and equipment is conditional on an agreement between Canada and the receiving state prohibiting their use for any nuclear explosive purpose. Such exports are now only made to countries that are signatories of the NPT or that accept equivalent full-scope safeguards.

Canada recognized that the IAEA would need new equipment and techniques to apply safeguards effectively, and that the IAEA's financial and manpower resources were insufficient to develop them. The Canadian program has been directed primarily toward safeguards for CANDU power plants.[6,7] It has been jointly funded and managed by the AECB and AECL.

The principal areas of endeavor have been:

- manpower assigned to work at the IAEA as cost-free experts in various fields applicable to safeguards needs;
- training of IAEA staff;
- assistance in the development of systems studies;
- development of safeguards equipment; and
- provision of safeguards equipment to the IAEA free of charge for some CANDU stations.

The CANDU reactor is more complex to safeguard than some other types of power reactor for two reasons. First, the CANDU reactor is refuelled while operating at full power so that fuel is moved from the core to storage almost daily. Most power reactors shut down at intervals of about once a year to refuel. Secondly, the CANDU fuel assemblies are small compared, for example, to LWR assemblies so there are many more of them to keep track of. The IAEA can fairly readily verify the fuel movements at an LWR, but may have difficulty in confirming the operator's records of the number of fuel assemblies discharged from a CANDU reactor.

Under the safeguards support program, Canada in conjunction with the IAEA developed a scheme for safeguarding CANDU 600 stations. The scheme involves the use of several types of equipment, some of which had to be developed from scratch.

The equipment required includes:

- time-lapse film cameras;
- time-lapse closed-circuit television (CCTV);
- counters for irradiated fuel bundles discharged from the reactor and transferred to the storage bay;

- a system to seal stacks of trays of spent fuel; and

- means to verify that the bundles in the storage bay are real irradiated fuel bundles and not dummies.

The film cameras and CCTV are used for surveillance of the fresh fuel handling area, the refuelling machine areas and the spent fuel storage bay area. The IAEA uses its own Minolta film camera systems at CANDU stations. AECL developed a multiplexed CCTV system with which the signals from eight cameras can be recorded on one videotape. The playback unit allows the inspector to review the eight camera records one at a time. The IAEA is using these CCTV systems at several locations.

The counters for irradiated fuel bundles each use two or more radiation detectors to determine and record the number of bundles moved and the direction of movement. These counters are installed at most CANDU reactors and are planned to be installed at others in the next year or so.

Ultrasonically verifiable seals were developed for use in the irradiated fuel storage bays. Each seal contains a randomly shaped coil of wire that gives the seal a unique identity and indicates whether or not the seal has been tampered with. These seals are attached to threaded rods or studs to hold covers in place over stacks of trays holding the fuel bundles. A seal cannot be removed without destroying its "signature." The instrument to read the seal signatures was developed by Sandia National Laboratories, Albuquerque.

One instrument developed to verify irradiated fuel underwater is the Cerenkov Viewing Device (CVD). It is based on the same principle as the night vision device used by the military, but the CVD is designed to see only ultraviolet light. Thus, under the right room lighting conditions, it can be used to observe the ultraviolet end of the spectrum of Cerenkov light generated by irradiated fuel in water. The U.S. and Japanese safeguards support programs have also developed CVDs with somewhat different features. For CANDU fuel, the CVD is best used for verifying fuel not contained within stacks of trays.

The IAEA needs means to verify irradiated fuel bundles within their containment units without the fuel having to be moved. Facility operators are reluctant to move fuel once it has been placed in its final storage bay location because of the personnel and time involved and because of the possibility that fuel might be damaged. Development is underway on a tool combining an underwater TV camera and a radiation sensor that can be lowered into or around the fuel stacks to allow counting and attribute verification of fuel bundles.

Labour Requirements to Accommodate IAEA Safeguards Inspections in Canada

The foregoing remarks show that Canada's safeguards activities fall into two general areas: activities directly related to safeguards inspections, and activities related to the safeguards support program.

Inspections

As stated earlier, for AECL Research Company every IAEA inspection person day requires about two person days of facility effort in support. The conditions for recording and handling nuclear materials are not radically different at bulk handling plants from those at AECL. Therefore, it seems reasonable that the 2:1 ratio for facility to IAEA personnel can be assumed for bulk plants as well. For CANDU reactors, a ratio of 1.5:1 appears to be more appropriate. Based on the person days of inspection stated in Note 3, the total Canadian nuclear facility personnel support for IAEA safeguards inspections in 1987 can be estimated as in Table 8. The total operator effort for all the facilities together adds up to about 1 800 person days annually. Assuming 225 working days per year, 1 800 person days is equivalent to eight person years.

The AECB Safeguards and Security Division currently has a staff of 13 working full-time to fulfil its responsibilities under Canada's agreement with the Agency.

Table 8

Facility Personnel in Support of IAEA Safeguards Inspection in Canada in 1987

Facility	IAEA Person Days	Ratio, Facility to IAEA Person Days	Estimated Person Days (rounded)
CANDU Reactors	864	1.5:1	1 300
Fuel Fabrication Plants	50	2:1	100
AECL Research Co.	166	2:1	330
Others	38	2:1	80
Totals	**1 118**		**1 800**

Safeguards Support Program

Between the two organizations, the AECB and AECL expended over ten person years in direct labour on the support program in 1987. Total personnel indirectly funded by the support program through contracts, etc., has not been estimated.

The safeguards support program involves CANDU station operators as well. Prototype safeguards equipment is demonstrated and evaluated at the stations, which involves operator staff through the stages of planning, installation, demonstration, removal and evaluation. Some of this time may be paid for by the support program.

Later, when the fully developed equipment is ready to be installed, the operator's assistance is again required. New equipment rarely works perfectly, hence repairs as well as routine maintenance of the equipment are needed from time to time. About 20 person days of effort were required of the Point Lepreau Station during such activities in 1987. These person days are in addition to those directly related IAEA inspections.

Summary

In 1987 the facilities using nuclear materials in Canada expended all together some eight person years of effort in support of IAEA safeguards inspections. The facility operators tend to look upon safeguards more as a nuisance to be tolerated than an unreasonable expense. To carry out its responsibilities under the safeguards agreement, the AECB currently expends 13 person years of work annually, roughly 1.5 times that of all the facilities together.

The total effort expended on safeguards support program activities by the AECB, AECL, the facilities and others could equal, but more likely exceeds, the total effort required to meet the country's obligations under the safeguards agreement.

IAEA safeguards are a vital part of Canada's nuclear non-proliferation policy. Considering the size of the nuclear industry in Canada, the cost to Canada of safeguards implementation activities within the country is really rather small.

Notes

1. IAEA, "The Structure and Content of Agreements between The Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons," INFCIRC/153 (corrected), 1972.
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Chapter 8. Summary of Discussions

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The various presentations (see preceeding chapters) generated wide-ranging, frank and open discussions. For this reason, it was decided to summarize these discussions on a broad thematic basis. What follows, then, is not a verbatim record but rather a re-organized and condensed report of the discussions.

The various points made are arranged in four general categories — two political in nature, two others, administrative and technical. The divisions, of course, are somewhat arbitrary, and reflect personal perspective as much as the "objective" characteristics of the issues under discussion. Issues actually arose under a variety of specific headings, but are presented here under the four chosen categories.

The two political sections touch on issues relating to the general political environment of a Chemical Weapons Convention and the negotiations for such a Convention, as well as on aspects of the structure and operations of an Organization for the Prohibition of Chemical Weapons (OPCW). The administrative and technical sections touch on administrative matters in an OPCW, and on particular scientific-technical questions regarding verification techniques.

External Political Issues

Discussion focussed in part on the specific aims of the proposed CWC. The proliferation of chemical weapons in non-European regions was seen to be equally as important as the existing stocks and asymmetry in Europe. Furthermore, participants said one might pay too much attention to technical safeguards — to counteract diversion scenarios — when it was unlikely that a country determined to violate the convention would choose a course of action that could be readily detected. Such a focus, then, is insufficient. Moreover, when thinking of the IAEA/NPT experience, one should not confuse the

political definition of "non-proliferation" with what the NPT was actually intended to do. A lack of congruity between the IAEA and the NPT in terms of verification was noted; care should be taken to ensure that the scope of a CW treaty is reflected in its verification provisions.

A second area of debate concerned general CWC costs, benefits and attendant trade-offs. While national security might be served by a CWC, it could also be threatened through abuse of the verification mechanisms; there has to be a balance between security and intrusiveness. On the possibility that sovereignty might be threatened by intrusive verification, it was argued that part of sovereignty involved providing security against attack. States join an agreement because they think their security will be enhanced. While challenge inspections contain risks of espionage, the treaty-related gains could be worth the risks. However, non-superpower states could be at a disadvantage relative to the superpowers in the area of challenge inspection, since they could not retaliate as readily against the superpowers with challenge inspections.

On the matter of financial costs, the view was expressed that $100 million per year or more might be a reasonable estimate of operating costs for a CWC verification organization. The question was raised: would states support this, especially given that it would represent an additional expenditure? There was disagreement on this point. Some suggested that the cost would not be important; even $100 million would not be too high a price to pay for safeguards as compared to the cost of military development programs. Others argued that the security benefit of a CWC would only be one component of the cost-benefit calculation and that other factors would have to be considered as well. It appears that most states do not feel threatened by chemical weapons and so might be reluctant to put forward so much money; the argument that a convention would enhance their security would not work. However, this attitude might change as states confront the implications of proliferation. Also, a comparison of the costs of a CWC with the costs of maintaining a chemical weapons capability only applies to those who have such a capability.

An easily overlooked aspect is the fact that costs will be very high for the initial period of operation of a CWC; that is, while existing weapons are being destroyed. Perhaps states with chemical weapons would bear a large portion of these costs. A better comparison for the cost of an OPCW was therefore with the costs of other arms control and disarmament agreements — such as the INF agreement — instead of the IAEA. Reports indicated that the U.S. was prepared to spend up to $200 million (and have 200 inspectors) in the first year of the INF agreement, followed by $110 million thereafter. In sum, therefore, the discussion suggested that one should look elsewhere than to the IAEA for suggestions for a cost baseline.

A controversial cost-benefit topic concerned (civilian) technical assistance trade-offs which might be sought by the Third World. Adding a technical assistance function, such as the IAEA has, would increase the costs of the OPCW. Some argued that technical assistance would not be relevant (see below) as the OPCW would be solely a control organization unlike the IAEA which also has a promotional role. Possible demands for a technical assistance provision in the CWC generated considerable debate. While some said the demands would be relatively harmless, others saw them as quite dangerous: they would divert attention from the focus of the convention; they could also have serious budgetary implications, since money spent on technical assistance would need to be allocated in addition to that required for safeguarding purposes. Some queried the basis for the suggestion that technical assistance might be considered as a "sweetener" to get less developed countries to sign a CWC, since some major recipients of IAEA assistance have not joined the NPT. A provision of this sort could also have implications for controls on strategic technology (with military applications).

Another significant area of discussion concerned the distribution of the verification effort under a CWC as compared to the distribution of risk. If safeguards efforts under a CWC were simply directed to the potential weapons capacity of chemical plants, the number of such plants, and to the materials accountancy approach, perhaps 80 per cent of safeguards efforts would be concentrated on countries such as the U.S., the U.K., Germany and Japan (this has been a problem with respect to the allocation of the IAEA safeguards effort). The safeguards might not be directed at the most likely areas of political risk, even if they were directed at the most risky plants in a technical sense. It is also difficult to distinguish between facilities capable of CW production, and those incapable of such production.

The question was also asked whether there is any way in which this can be avoided so that more effort could be directed to geographic areas of concern. Could a random approach be used, or one that weighted states by risks? Could one combine a random and a weighted approach, or let the inspectorate decide? Could states suggest target states? Could the safeguards be considered as CBMs, so that parties to a CWC could view them as an opportunity to show their good faith? No real basis was seen to exist for any of these suggestions. A state of "no concern" to some might be of concern to others. States could not be treated differently: who was to judge who was suspicious and who was not? There would therefore be no basis on which to weight safeguards activities towards suspicious states. Because the West probably has the largest number of chemical plants, random inspection could end up as self-inspection. Moreover, some considered a high concentration on OECD and East European plants was unavoidable. Covering plant and states of relatively little concern, it was suggested, might be regarded as an "entry price" for getting coverage in areas of greater concern: such an entry price would be high for a global organization.

Given these cost-benefit problems, is the discussion in Geneva heading down the wrong road? What assurances will states seek? What costs are states willing to pay? Could a more political and a less technical regime — e.g., one obviously reinforced by national technical means — be better?

Third World states arose as an issue in another context: they tend to be overlooked by focussing too much on East-West concerns. There is a great potential for the proposed CWC to unravel if it is less than global in scope. What are the attitudes and interests of Third World states regarding a CWC? Each Third World state has to be considered separately since each often has separate problems and concerns. Nonetheless, some general Third World perceptions were identified, including:

- a concern that CW negotiations are a way to divert attention from nuclear weapons;
- a desire for non-discriminatory verification, unlike the NPT;
- a desire to have the verification system treated as a ceiling, not as a floor (i.e., that there should not be additional controls); and
- a desire for assistance against use and for defence training.

Other discussion themes included the following:

1. It would be desirable to separate the OPCW from the UN, to avoid interference by non-parties in its operation, and also to reduce the possibility of a carry-over of certain undesirable habits and attitudes from UN bodies.

2. Economies of scale might suggest establishment of a general verification organization, rather than different organizations for each treaty. Some argued that the Director General of such an organization would not have the specific necessary knowledge, while he/she has a major role in organizations centred on specific treaties. It was suggested, however, that as the disarmament process developed, a disarmament organization could be streamlined.

3. A question arose about review (as opposed to amendment) procedures: are procedures proposed for the review of the implementation of a CWC? If such procedures were desired, who would conduct the review? The NPT has no such provision or organization and so depends on the UN to run its Review Conferences; the CWC, however, would have the OPCW.

4. A CWC might provoke political and regulatory concerns at the state level, for example, concerning searches without warrants in the context of the chemical industry and the Fourth Amendment of the U.S. Constitution. It was suggested that a challenge inspection would not be that intrusive. A problem of extra-territoriality was also noted: e.g., if a multinational chemical corporation whose home state signs the CWC has a subsidiary in another state which does not sign it, how would this be handled?

5. The IAEA safeguards experience has shown that no set of safeguards can provide assurance against bad intentions. This is as much a political issue as it is a technical/ operational one. Absolute assurance is not possible. One should have realistic expectations, not just idealistic ones.

6. The experience of the IAEA has shown that universality is not achievable, even given the "limited" number (1.5 million!) of data entries handled by the IAEA. The CWC number of data entries would probably be much, much larger. One would have to ask the question: would a 5 per cent or even a 10 per cent deviation be really indicative of a deliberate attempt to contravene the principles of the CWC?

Political Aspects of an OPCW

Participants generally agreed on the desirability of a small, strong executive, with considerable power relative to a General Conference of members; on the crucial role of the Director General; and on the need for both a strong negotiating group within the organization and a capability for flexibility in dealing with states, e.g., in the negotiation of facility attachments.

There was some discussion about whether the executive of an OPCW would be more or less powerful than that of the IAEA. Some states seem to want power located in the General Conference rather than the Executive Council. With respect to the size of an Executive Council, it was noted that the size of the executives of UN bodies had increased over time; it was suggested, however, that this is in part due to the increase in the number of states. As this process is approaching its end, this pressure might be reduced. In general, it was noted that the Third World states tended to favour a large executive.

With respect to the composition of an executive, some wondered whether a formula could be found to give states carrying a greater burden of inspection greater representation, but others found this unlikely. Formulas put forward thus far have included geographic, industrial and political factors, with the political factors generating considerable controversy. Some felt that it might be advantageous to appoint representatives from the chemical industry in particular. It was also suggested that possible parallels be sought in the International Seabed Authority

proposed under the 1982 Law of the Sea Convention, since the executive of that body gives explicit recognition to a variety of constituencies in its composition. Participants observed that this sort of body could readily become deadlocked, partly because of its complex voting rules. Some, however, noted that a small, strong executive could also be deadlocked.

Procedures for assessing matters related to compliance raised a number of concerns; this issue is still very much on the negotiating agenda. Various preferences have been expressed in the CD and, for the time being, no consensus is in sight.

Within the Technical Secretariat, the crucial role of the Director General was noted: he/she is likely to stay in office for a long time, and authority tends to increase over time. He/she should not be subjected to political pressures. Automatic procedures, such as requiring him/her to report to the executive if an agreement were breached, could relieve some of these pressures. However, the role is undefined to date.

It was felt that the question of the authority of the Secretariat is probably more important than might initially seem to be the case. A matter of particular importance, which would require a Secretariat with strong powers to negotiate, might be the negotiation of facility attachments to apply safeguards to specific facilities. Such negotiations could take some time, and there could be difficulties in negotiations with plant operators and middle-level authorities. Furthermore, there is a need to preserve flexibility in the verification agency's position so that it can respond to and accommodate future developments, and avoid an erosion of rights as one moves from a general agreement down to the level of facility attachments.

On financial issues, the question of a scale of assessment was discussed. It would be easy to use the UN scale method, but there could be resistance from some states which might not feel particularly involved or interested. It was noted that the IAEA had introduced a special scale for less wealthy states for safeguards costs.

Finally, co-operation as a leading concept was mentioned. Verification can be done in an adversarial or a co-operative spirit. While the co-operative spirit is certainly preferable, it would not mean acquiescence. Even if there is an unannounced inspection, or a challenge inspection, the principle of co-operation should be the governing one, it was felt.

Administrative Aspects of an OPCW

Three broad areas emerged here: personnel policies; the handling of anomalies and issues of compliance; and challenge inspections.

The personnel or human side of verification was considered a very important issue that should not be underestimated. To be effective, the international inspectorate will require a yet-to-be-determined number of qualified inspectors, and they will have to be retained in the Secretariat in the face of the inducement of potentially lucrative positions in the chemical industry. Salary levels are probably only one aspect of the issue. It might be necessary to consider term appointments of industrial employees, with a guarantee of returning to their position after employment with the verification agency ends. The IAEA experience has been that inspectors are highly motivated when hired and most stay with the Agency for many years, but this could be due in part to a lack of employment opportunities outside the Agency, considering the limited number of nuclear facilities.

A major lesson to be learned from the IAEA experience is that it is best to resolve or clarify "anomalies" (i.e., any observation of malfunctioning of surveillance equipment, difficulties of reconciling material accounts, etc.) observed in the verification process in a quiet, non-dramatic, "in-house" manner. Non-compliance can be very ambiguous and hard to determine: the term "anomaly" was created to cover a variety of situations where there may be some concern about compliance. But, who assesses compliance and determines that there is non-compliance? Do states simply reach their own conclusions?

It might be good to have a body (in the form of the OPCW) report that it cannot confirm compliance, since this would put the burden of proof on the reporting state. Current thinking seems to be that, in the case of an anomaly, the Secretariat would contact the state concerned and seek to clarify the matter; if the issue was not resolved at that stage, it then would be raised with the Director General. But, would he/she conclude that there was non-compliance, or would this go to the Executive Council for consideration and a final decision? It was suggested that there could be advantages in "naming names" of parties that were delinquent, but only if very few parties were actually delinquent: otherwise, the effect would be lost.

On the matter of challenge inspections, it was suggested that the IAEA not only does not have, but also does not want, challenge inspections, as these are usually seen to carry an element of suspicion in them. The IAEA preferred method would be to use routine and unannounced inspections (unannounced meaning access in terms of hours, not minutes). While the IAEA provides for extra inspections in facilities normally under inspection, it does not engage in challenges, e.g., in the sense of inspecting undeclared facilities.

The way in which challenge inspections would be used was perceived as a concern as well. Would such inspections be regarded as a high-profile, political measure, or as a tool to be used? If they were not used early on, could it become

more difficult to use them later — i.e., a "use them or lose them" problem? Could challenge inspections be used too much? How could one guard against frivolous challenges while being able to respond quickly to serious ones? If a screening mechanism were contemplated, in deciding whether or not a challenge was frivolous, this approach might require access to evidence of considerable sensitivity which a challenger might not be willing to produce for reasons of security. Would it be possible or likely that a suspicious state might approach another, bilaterally?

The composition of a challenge inspection team, and the handling of the costs and its findings, were also matters of discussion. In terms of composition, a challenged state might be able to accompany a team (though not be a member of it) without, however, impeding its work. Should a challenging party be a member of such a team, or accompany it only in some other limited capacity? If the challenger is not part of the team, how could the findings provide reassurance for the challenger? On the other hand, if it is, (aside from the espionage problem) would such a member not feel obliged to write a dissenting (minority) report if the team as a whole were to find nothing?

Who should pay the costs of a challenge inspection? Should the challenger pay the entire cost if there is no finding? But there could still be ambiguities, and in such a case who would pay? How should industry claims arising from disruption of activities, etc., be dealt with? In the case of the IAEA, the industry can make a claim for costs arising from additional work not specified in facility attachments, but this seldom happens.

Technical Aspects of Verification

In considering difficulties related to verification of non-production of chemical weapons, the participants were particularly aware of the differences in scope of the nuclear and chemical industries. (A particularly helpful comparison of verification of non-production of chemical and nuclear weapons can be found in a paper by B. ter Haar and P. de Klerk, *Arms Control*, *8*(3), 197–212, 1987).

Some obvious differences include the following:

- The nuclear industry is highly specialized, whereas the chemical industry is extremely diverse.
- The nuclear industry is considerably smaller than the chemical industry.
- The nuclear industry deals with the traceable flow of a few "finger-printed" compounds, while the chemical industry deals with larger, more complex and less readily tracked flows and materials.

- Nuclear safeguards are not uniformly imposed on all member states or facilities. In a CWC, protecting the interests of weaker states would be a major consideration.

- The IAEA is both a safeguarder and an information supplier, but it is questionable whether an OPCW would or should act in this second capacity.

- While the IAEA can be proud of its achievements with respect to safeguarding, there are routes other than diversion which could lead to the production of nuclear explosives. A parallel in the CWC would have tight control of chemical industries while leaving weapons production facilities untouched. This is certainly *not* the intention of the CWC.

Thus, the IAEA's safeguards operations can serve only as a case study for very general design purposes.

It was noted that the technical and commercial circumstances of the chemical industry could disqualify many specific methods used today by the IAEA. It will be necessary to recognize this and not simply try to copy IAEA approaches. It was suggested that perhaps the IAEA underestimated the technological problems it faced and overestimated the available technical capabilities. Some argued that a great deal of preparatory research into technical approaches to chemical weapons verification would be needed prior to CWC implementation. Problems with the lists of chemicals under control were also noted: such lists can rapidly become obsolete, and there are concerns about available methods of analysis.

With respect to the adoption of new technology for verification purposes, it was also noted that immediate requirements tended to take priority over the longer-term ones. As well, the system has to be understandable at the political level. States will want to know where their money for verification research and development is going, what results are achieved, what information is necessary, and so on. The political credibility of a technical system was thus identified as an important factor. The necessity of allowing flexibility in the adoption of new technologies was emphasized: it may be prudent not to be too specific with respect to technology to be used for verification purposes, otherwise the industry to be verified may evolve much more quickly than the instruments and procedures available to inspectors.

Information control problems, it was noted, included not only concerns related to the loss of proprietary information but also a variety of security problems. It was noted that the inspection process itself could be a source of leakage of information. While some felt that initial concerns about proprietary

information under the NPT had proved to be much greater in theory than in practice, others suggested that confidentiality could be a greater problem under a CWC. What information should be provided to the agency's executive? Should declarations be public or restricted? If they are restricted, who gets them? What information is needed by concerned parties to keep them satisfied? It was noted that the IAEA Board does not see facility attachments; it was also noted that it was desirable to keep facility attachments confidential to prevent states from pressing for the lowest levels of control. On the matter of sensitivity of commercial information, it was argued that the need for protection of sensitive information would decline as one moves away from individual plant data, once data become more processed and condensed.

In conclusion, the workshop was conducted in a manner that allowed for open discussion and a free flow of ideas, and there was no intention to close the event with specific resolutions, definitive statements or recommendations. As Dr. Critchley pointed out in her closing speech, the discussions quite often addressed technical questions which, as it turned out, were seen not to have a great deal in common with IAEA experience. The consideration of political and organizational issues, on the other hand, could certainly benefit from a closer examination of IAEA experience than this workshop was able to achieve in the time available.

Chapitre 8. Résumé des discussions

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Les divers exposés ont engendré des discussions à la fois variées et particulièrement franches et ouvertes. C'est pourquoi il a été jugé souhaitable de résumer les débats dans un chapitre distinct plutôt qu'à la fin de chacun des exposés, de manière à structurer les idées lancées en fonction des grands thèmes qui se dégagent. Les pages qui suivent, par conséquent, ne sont pas un compte rendu sténographique des débats mais plutôt une restructuration et une synthèse de ces discussions.

Les diverses questions traitées sont réparties en quatre catégories générales, dont deux de caractère politique, l'une administratif et l'autre technique. Bien sûr, ces réparititions sont quelque peu arbitraires puisqu'elles sont le fruit aussi bien de l'optique choisie que des caractéristiques « objectives » des questions examinées. Celles-ci ont été soulevées dans le cadre des divers sujets particuliers à l'ordre du jour, mais elles sont présentées en fonction des quatre catégories retenues.

Les deux sections de politique portent sur des questions découlant de la situation politique générale dans laquelle s'inscrivent la Convention sur les armes chimiques ainsi que les négociations y afférentes, d'une part, et sur des aspects de la structure et des opérations de l'Organisation pour l'interdiction des armes chimiques (OIAC), d'autre part. Les sections d'ordre administratif et technique se rapportent à l'administration générale de l'OIAC envisagée et soulèvent des questions particulières scientifiques et techniques concernant les méthodes de vérification.

Questions de politique extérieure

Un des grands thèmes de discussion a été l'objet et les buts particuliers de la Convention sur les armes chimiques (CAC). Pour certains participants, le véritable problème ne se pose pas uniquement en Europe, mais également dans

d'autres régions où les armes chimiques sont susceptibles d'être utilisées, de sorte que la question de la prolifération des armes chimiques est jugée au moins aussi importante que celle des stocks et de l'asymétrie que l'on peut observer actuellement en Europe. Par ailleurs, on pouvait être tenté d'accorder trop d'attention aux garanties techniques, comme mesures destinées à contrer les possibilités de diversion, alors qu'il est peu probable qu'un pays déterminé à violer les dispositions de la convention choisisse une ligne de conduite présentant de fortes probabilités de détection. Cette façon d'aborder la question est donc jugée insuffisante. Il ne faut pas, à propos de l'AIEA et du TNP, confondre la définition politique de « non-prolifération » avec l'objet réel du TNP. On a fait également observer l'absence de conformité parfaite entre l'AIEA et le TNP sur le plan de la vérification, de sorte qu'il importerait de veiller à ce que la portée du traité éventuel sur les armes chimiques se reflète dans ses dispositions de vérification.

La discussion a porté également sur les coûts et les avantages généraux de la Convention sur les armes chimiques, de même que sur l'équilibre à atteindre à cet égard. De l'avis de certains, si la sécurité nationale pourrait gagner à s'appuyer sur une CAC, elle pourrait également s'en trouver menacée, par exemple dans les cas d'abus des mécanismes de vérification, de sorte qu'il importe de trouver un juste milieu entre la sécurité et l'intrusion. La difficulté de faire accepter aux États-Unis leurs propres propositions de vérification des FNI n'a pas manqué d'être soulevée. Au sujet de la possibilité que la souveraineté soit menacée par des vérifications indiscrètes, certains estimaient que la souveraineté reposait en partie sur une garantie de sécurité contre les attaques. Si les États décident d'être parties à un accord, c'est qu'ils jugent que leur sécurité s'en trouvera renforcée. Certes les inspections par mise en demeure pourraient entraîner des risques d'espionnage, mais les avantages découlant d'un traité pourraient nettement l'emporter sur les risques. Toutefois, les États qui ne sont pas des superpuissances pourraient se trouver désavantagés par rapport aux superpuissances dans ce domaine des inspections par mise en demeure, du fait qu'ils ne sont pas en mesure d'appliquer la loi du talion.

Au chapitre des coûts, on a pu avancer que 100 millions de dollars par an ou davantage pourrait être une estimation raisonnable des frais d'exploitation de l'organisme de vérification de la CAC. La question qui en découle est la suivante : les États accepteront-ils ces dépenses supplémentaires? Sur ce point, on note des désaccords. Les uns étaient d'avis que les coûts n'étaient pas importants, c'est-à-dire que même si 100 millions de dollars peut sembler un montant considérable, ce n'est pas payer trop cher pour obtenir des garanties en comparaison de ce que coûtent les programmes de développement militaire. Les autres ont fait valoir que l'avantage que pourrait présenter une CAC pour la sécurité n'était qu'un élément de l'analyse coûts-avantages et que cet avantage, à lui seul était insuffisant. La plupart des États, semble-t-il, ne se sentent pas

menacés par les armes chimiques et seraient donc réticents à fournir un apport financier : l'argument voulant qu'une convention ait pour effet de renforcer leur sécurité ne risque guère de les convaincre. Toutefois, cette attitude pourrait bien changer au moment où les États devront faire face aux implications de la prolifération. Il faut dire que la comparaison des coûts d'une CAC avec ceux du maintien d'un arsenal d'armes chimiques ne peut s'appliquer qu'aux États dotés d'un tel arsenal.

On a souvent tendance à oublier que les coûts seront vraisemblablement très élevés pendant la période initiale de mise en œuvre de la CAC, soit au moment de la destruction des armes existantes. Les participants considéraient que les États possédant de telles armes assumeraient une part importante des coûts et que pour se faire une idée de l'ampleur des coûts de l'OIAC, il fallait se tourner non pas du côté de l'AIEA mais plutôt examiner les coûts d'autres accords de limitation des armements et de désarmement, comme l'accord sur les FNI. Selon certaines affirmations, les États-Unis sont prêts à dépenser jusqu'à 200 millions de dollars et à mettre à contribution 200 inspecteurs pendant la première année de l'accord sur les FNI, puis 110 millions de dollars par la suite. Il ressort des débats qu'il vaudrait mieux choisir un autre étalon que l'AIEA pour essayer de préciser les coûts de base.

Une autre question, controversée, où il convient de peser soigneusement les coûts et les avantages a trait à l'assistance technique (civile) que demande le tiers monde en contrepartie. L'ajout d'une fonction d'assistance technique, comme celle de l'AIEA, aurait pour effet d'accroître les coûts de l'OIAC. Certains ont fait valoir que l'assistance technique ne serait pas pertinente (voir également plus loin) du fait que l'OIAC ne serait qu'un organisme de contrôle et non également un organisme de promotion comme l'est en partie l'AIEA. Les exigences possibles d'une dimension d'assistance technique dans la CAC ont suscité de longs débats. Si les uns considéraient ces exigences comme relativement anodines, les autres y voyaient de réels dangers : celles-ci pourraient détourner l'attention de l'objet même de la convention, et il pourrait y avoir de graves incidences budgétaires, étant donné que l'argent consacré à l'assistance technique devrait s'ajouter aux sommes nécessaires pour assurer les garanties. Certains se sont interrogés sur la valeur de l'assistance technique comme mécanisme destiné à « dorer la pilule » et engager les pays en développement à signer la CAC. On a fait observer que les principaux bénéficaires de l'aide de l'AIEA n'étaient pas devenus parties au TNP. À propos d'une autre question, on a également signalé que ce genre de dispositions pourraient avoir des répercussions sur le contrôle de la technologie stratégique (avec application militaire).

La répartition des responsabilités de vérification en application d'une CAC, par comparaison avec la répartition du risque, a été un autre domaine important de discussion. Si la répartition des responsabilités relatives aux

garanties était simplement liée à la capacité théorique des usines chimiques à produire des armes, au nombre d'usines de ce genre et à l'obligation de rendre compte des matières de base, 80 p. 100 des efforts risquent de porter sur des pays comme les États-Unis, le Royaume-Uni, l'Allemagne et le Japon (ce qui a créé des difficultés dans la répartition des exigences de garanties de l'AIEA). Les garanties pourraient ne pas viser les aspects les plus susceptibles de poser un risque politique, même si elles étaient appliquées aux installations comprenant le plus haut degré de risque sur le plan technique. Il faut voir également qu'il existe une difficulté réelle à distinguer entre les installations capables de produire des armes chimiques et celles qui n'ont pas cette capacité.

À cet égard, plusieurs questions ont surgi : serait-il possible d'éviter le problème ou du moins insister davantage sur les secteurs géographiques préoccupants? Pourrait-on avoir recours à une méthode aléatoire ou accorder aux États des cotes de pondération en fonction du risque? Pourrait-on regrouper la méthode aléatoire et celle des cotes de pondération, ou laisser l'inspection décider? Les États pourraient-ils suggérer des États-cibles? Les garanties pourraient-elles être considérées comme des mesures de restauration de la confiance, de manière à ce que les parties à l'éventuelle CAC y voient l'occasion de montrer leur bonne foi? On n'a pu trouver aucun fondement réel qui permettrait à ces suggestions de porter fruit. Un État pourrait ne pas causer d'inquiétude à certains États mais être un sujet de préoccupation pour d'autres. Il est difficile de traiter les États de façon différente : qui peut juger si tel État est suspect tandis que l'autre ne l'est pas? Il n'y aurait donc aucun fondement permettant de pondérer les activités de garanties pour les États suspects. Étant donné que c'est l'Occident qui dispose sans doute du plus grand nombre d'usines chimiques, les inspections aléatoires pourraient bien se transformer en auto-inspections. Pour certains intervenants, il serait difficile d'éviter de se concentrer sur les usines des pays de l'OCDE et sur celles des pays de l'Europe de l'Est. L'inclusion des usines et des États, a-t-on affirmé, qui causent relativement peu de soucis pourrait être considérée comme un « prix d'entrée » donnant accès à des secteurs plus préoccupants, mais ce prix d'entrée serait élevé pour un organisme international.

En raison de ces problèmes liés à la détermination des coûts et des avantages, ainsi que de la répartition des activités par rapport à la répartition du risque, les discussions de Genève se sont-elles engagées dans une voie sans issue? Quel est le degré d'assurance que les États sont prêts à accepter? Quels coûts les États sont-ils prêts à assumer? Un régime plus politique et moins technique — c'est-à-dire, évidemment, renforcé par des moyens techniques nationaux — pourrait-il s'avérer supérieur?

La question des États du tiers monde est revenue sur le tapis dans un autre contexte : on a tendance à les oublier en insistant trop sur les intérêts Est-Ouest. Le traité proposé risque fort de s'effriter s'il n'est pas ratifié à l'échelle

mondiale. Quelles sont donc les attitudes et les intérêts des États du tiers monde à l'égard d'une CAC? On a pu faire observer qu'il fallait considérer les États du tiers monde individuellement : les problèmes des uns ne sont pas forcément les problèmes des autres. Il a été malgré tout possible de dégager certaines perceptions et attitudes générales de la part de ces États :

- la crainte que les négociations sur les armes chimiques soient une façon de détourner l'attention des armes nucléaires;
- un désir de vérification non discriminatoire, contrairement à ce qui se passe pour le TNP;
- le vœu que le système de vérification soit considéré comme un maximum et non un minimum (c'est-à-dire qu'il ne devrait pas y avoir de contrôles supplémentaires);
- le désir d'obtenir de l'aide contre l'utilisation des armes chimiques et dans le domaine de la formation de défense.

Voici d'autres thèmes mineurs qui ont fait l'objet de discussions :

1. Il serait souhaitable que l'OIAC soit distincte de l'ONU, pour éviter l'ingérence des non-signataires et également pour réduire la possibilité de transfert de certaines habitudes ou attitudes indésirables des organismes de l'ONU.

2. Il serait peut-être préférable de disposer d'un organisme général de vérification, plutôt que d'un organisme différent pour chaque traité, pour des raisons d'économie d'échelle. Contre cette proposition, on a fait valoir que le directeur général d'un tel organisme ne pourrait avoir les connaissances particulières nécessaires, alors qu'il peut jouer un rôle de premier plan dans les organisations axées sur un traité particulier. Toutefois, il serait peut-être possible, à mesure que le processus de désarmement évoluera, de créer une organisation de désarmement rationnelle.

3. Une question s'est posée concernant les procédures d'examen (par opposition aux procédures d'amendement) : a-t-on proposé des procédures pour l'examen de la mise en œuvre de la CAC? Si ces procédures sont jugées souhaitables, qui serait chargé de l'examen? Le TNP ne contient pas de dispositions à cet égard et dépend donc de l'ONU pour la direction des séances d'examen; la CAC, pour sa part, s'appuierait sur l'OIAC.

4. On a fait observer que certaines questions de politique et de réglementation intérieures pourraient être soulevées dans le cadre de la CAC, concernant par exemple les perquisitions sans mandat visant l'industrie chimique et le quatrième amendement à la constitution américaine. Pour certains, les inspections par mise en demeure ne seraient pas exagérément importunes. Un problème d'extraterritorialité a également été signalé : le cas où une société multinationale de produits chimiques ayant son siège social dans un État partie à la CAC et qui dispose d'une filiale dans un autre État non signataire. Que ferait-on dans cette situation?

5. L'expérience des garanties de l'AIEA a démontré qu'un ensemble de garanties est insuffisant pour se prémunir contre les mauvaises intentions. Il s'agit là d'un problème politique tout autant que technique ou opérationnel. Une assurance absolue n'est pas dans l'ordre du possible. C'est pourquoi il convient de formuler des objectifs réalistes et non uniquement idéalistes.

6. L'expérience de l'AIEA a montré qu'il était impossible d'en arriver à une universalité totale, même compte tenu du nombre « limité » (1,5 million!) de groupes de données traitées par l'AIEA. Le nombre des groupes de données à traiter dans le cadre de la CAC serait probablement beaucoup plus important et il faudrait se poser la question suivante : un écart de 5 p. 100 ou même de 10 p. 100 serait-il vraiment indicatif d'un essai délibéré de contrevenir aux principes de la CAC?

Aspects politiques d'une OIAC

On semble s'être entendu de façon générale sur l'opportunité de disposer d'un petit conseil exécutif dynamique, investi de pouvoirs considérables par rapport à la Conférence générale des membres, sur le rôle décisif du directeur général, ainsi que sur la nécessité d'un groupe de négociation énergique au sein de l'organisation et de structures souples pour traiter avec les États, notamment pour la négociation des accords subsidiaires relatifs à des installations.

On a discuté de la question de savoir si le conseil exécutif de l'OIAC jouirait de plus ou de moins de pouvoirs que celui de l'AIEA. Certains États préfèrent que le pouvoir appartienne à la Conférence générale plutôt qu'au conseil exécutif. En ce qui a trait à la taille du conseil, on a fait remarquer que les conseils des organismes de l'ONU étaient devenus de plus en plus nombreux avec le temps, en partie peut-être à cause de l'augmentation du nombre des États. Comme le processus touche à sa fin, il est possible que les pressions s'en trouvent réduites. De façon générale, on a fait remarquer que les États du tiers monde avaient tendance à favoriser les grands conseils exécutifs.

Pour ce qui est de la composition du conseil, certains se sont demandé s'il n'était pas possible de trouver une formule accordant aux États une représentation proportionnelle à la charge d'inspection assumée, mais d'autres ont jugé que l'adoption de cette formule était peu probable. Parmi les formules avancées, signalons l'intégration de facteurs géographiques, industriels et politiques, ces derniers suscitant une vive controverse. Certains estimaient qu'il serait avantageux de nommer des représentants de l'industrie chimique en particulier. Pour d'autres, il y aurait lieu d'examiner l'Autorité internationale des fonds marins, proposée dans la Convention de 1982 sur le droit de la mer, afin de trouver des parallèles possibles. Le conseil de cet organisme reconnaît explicitement diverses parties intéressées dans sa composition. Des participants jugeaient toutefois que ce genre d'organisme, embarrassé par surcroît d'un mode de scrutin complexe, pouvait facilement être complètement paralysé dans son action. D'autres ont rétorqué que même les petits conseils jouissant de pouvoirs étendus pouvaient aussi connaître la paralysie.

La procédure d'évaluation des questions liées à la conformité semblait, pour les participants, donner lieu à un certain nombre de préoccupations, d'autant plus que les négociations à ce sujet sont loin d'être terminées. Diverses préférences ont été exposées à la Conférence sur le désarmement mais, pour l'instant, on n'entrevoit pas de consensus.

À propos du Secrétariat technique, on a rappelé le rôle décisif du directeur général : cette personne risque de demeurer en fonction pendant une longue période et l'on sait que les pouvoirs ont tendance à s'accroître avec le temps. Elle ne doit donc pas être soumise à des pressions politiques. Des procédures fixes, comme l'obligation de faire rapport au conseil en cas de violation d'un accord, pourrait avoir pour effet de réduire ces pressions. Toutefois, pour l'essentiel, on a conclu que son rôle n'avait pas encore été défini jusque-là.

On a jugé que la question des pouvoirs du Secrétariat était probablement plus importante qu'on ne l'avait cru au départ. En particulier, le Secrétariat devrait sans doute jouir de pouvoirs plus étendus afin de négocier les accords subsidiaires relatifs aux installations pour l'application des garanties à des installations particulières. Ces négociations pourraient être assez longues et pourraient se heurter à des difficultés au niveau des exploitants d'usines et des autorités intermédiaires. Il importe en outre de préserver une marge de manœuvre pour l'Agence de vérification pour qu'elle puisse s'adapter à l'évolution de la situation et éviter l'effritement des droits dans le processus de particularisation qui consiste à passer d'un accord général à un accord subsidiaire relatif à des installations.

À l'occasion d'une discussion financière, on a abordé la question de l'ampleur de l'évaluation. Il serait facile d'adopter la méthode d'échelle de

l'ONU, mais celle-ci pourrait se heurter à la résistance de certains pays qui ne se sentent pas particulièrement engagés ou intéressés. On a fait observer que l'AIEA avait adopté une échelle réduite dans le cas des États moins riches pour le coût des garanties.

Enfin, on a mentionné la coopération comme concept fondamental. La vérification peut se faire dans un esprit d'opposition ou de coopération. Si l'esprit de coopération est indiscutablement à privilégier, il n'entraîne pas forcément l'acceptation. Même dans le cas des inspections non annoncées ou des inspections par mise en demeure, le principe de la coopération, selon les participants, devait demeurer le principe directeur.

Aspects administratifs d'une OIAC

Trois grands sujets ont été abordés dans cette catégorie : la politique en matière de personnel; le traitement des anomalies et les questions de conformité; les inspections par mise en demeure.

Le personnel de la vérification, ou le côté humain de cette activité, est apparu comme une question extrêmement importante ne devant pas être sous-estimée. Pour être efficace, l'inspection internationale devra pouvoir compter sur des inspecteurs compétents, dont le nombre reste à déterminer, et il faudrait être en mesure de retenir ces inspecteurs au Secrétariat malgré les postes lucratifs que peut offrir l'industrie chimique. Il pourrait être nécessaire d'envisager la nomination, pour une période déterminée, d'employés de l'industrie en leur garantissant la réintégration dans leurs fonctions après leur séjour à l'Agence de vérification. Si on se fie à l'expérience de l'AIEA, les inspecteurs sont extrêmement motivés lorsqu'ils sont engagés et la plupart demeurent avec l'Agence pendant de nombreuses années; mais cette situation pourrait peut-être s'expliquer en partie par les faibles possibilités d'emploi à l'extérieur de l'Agence, compte tenu du nombre limité d'installations nucléaires.

Un des enseignements importants que l'on peut tirer de l'expérience de l'AIEA, c'est qu'il vaut mieux résoudre ou éclaircir les « anomalies » (p. ex., observation d'une défaillance du matériel de surveillance, difficultés dans le rapprochement des matières comptabilisées, etc.), constatées dans le cadre du processus de vérification, de façon posée, non dramatisante, à l'amiable. La non-conformité peut être très ambiguë et difficile à déterminer : on a créé le terme « anomalie » pour tenir compte de diverses situations où il peut exister certains doutes concernant la conformité. Mais qui est chargé d'évaluer la conformité et de déterminer les cas de non-conformité? Les États tirent-ils tout simplement leurs propres conclusions?

Il pourrait être excellent de disposer d'un organisme (en l'occurrence l'OIAC) qui affirme ne pas être en mesure de confirmer la conformité, car la

charge de la preuve incomberait alors à l'État concerné. La solution que l'on semble privilégier actuellement en cas d'anomalie, c'est d'autoriser le Secrétariat à entrer en communication avec l'État concerné et à chercher à clarifier l'affaire. Si la question n'est pas réglée à cette étape, le directeur général en serait saisi. On se demande, toutefois, s'il prendrait sur lui de conclure à une non-conformité ou s'il porterait l'affaire devant le conseil exécutif pour obtenir une décision finale. D'après certains, il serait peut-être avantageux de préciser le nom des parties contrevenantes, mais seulement si très peu de parties sont prises en faute, car autrement l'effet serait nul.

Au sujet des inspections par mise en demeure, l'AIEA non seulement n'a pas recours à ce genre d'inspections mais ne veut pas y avoir recours, car elles sont le plus souvent considérées comme comportant un élément de suspicion. La méthode que privilégie l'AIEA est celle des inspections régulières et de quelques inspections sans préavis (« sans préavis » correspondant à un accès calculé en heures, non en minutes). Bien que l'AIEA prévoie des inspections supplémentaires dans les installations normalement visées par les inspections, elle n'a pas recours aux mises en demeure, par exemple pour inspecter des installations non déclarées.

La façon dont les inspections par mise en demeure seraient utilisées a également fait l'objet d'interrogations. Ces inspections seraient-elles considérées comme une mesure politique destinée à faire un éclat ou simplement comme un instrument de travail? Si l'on n'y a pas recours dans un premier temps, sera-t-il plus difficile de les mettre à contribution à une date ultérieure (c'est le dilemme du « maintenant ou jamais »)? Les inspections par mise en demeure pourraient-elles donner lieu à des exagérations? Comment éviter les mises en demeure injustifiées tout en étant en mesure de donner suite à celles qui sont sérieuses? Si l'on décide d'adopter des mécanismes de tri pour départager les mises en demeure non justifiées des autres, cette méthode pourrait supposer l'accès à des preuves de caractère particulièrement délicat, que l'auteur de la mise en demeure pourrait par conséquent être réticent à produire pour des raisons de sécurité. Serait-il possible ou vraisemblable qu'un État qui a des soupçons en approche un autre, bilatéralement?

La composition de l'équipe d'inspection par mise en demeure, ainsi que le traitement des coûts et des conclusions, ont également fait l'objet de débats. Pour ce qui est de la composition, l'État mis en demeure pourrait être autorisé à accompagner l'équipe (sans en être membre) à condition, évidemment, qu'il ne nuise pas à son travail. L'auteur de la mise en demeure pourrait-il être membre de l'équipe ou l'accompagner à un autre titre limité? Si l'auteur de la mise en demeure ne fait pas partie de l'équipe, comment pourrait-il se satisfaire des conclusions? En revanche, s'il en fait partie, abstraction faite du problème d'espionnage, ce membre ne se sentirait-il pas obligé de rédiger un rapport dissident (minoritaire) si l'équipe dans son ensemble ne découvre rien?

Qui devrait assumer les frais des inspections par mise en demeure? L'auteur de la mise en demeure devrait-il assumer la totalité des coûts si l'on ne découvre rien? Mais s'il demeure des ambiguïtés, qui devrait payer? Comment faudrait-il traiter les réclamations en dommages-intérêts des entrerprises dont les activités ont été perturbées? Dans le cas de l'AIEA, l'industrie peut réclamer les coûts découlant de travaux additionnels non précisés dans les accords subsidiaires relatifs à des installations, mais ces travaux supplémentaires ne se présentent pas souvent.

Aspects techniques de la vérification

Dans l'examen des difficultés liées à la vérification de la non-production d'armes chimiques, les participants étaient tout à fait conscients des différences d'ampleur qui existent entre les industries nucléaire et chimique. (Une source de réflexion particulièrement utile pour la comparaison de la vérification de la non-production d'armes chimiques et nucléaires est un article de B. ter Haar et P. de Klerk, *Arms Control*, 8(3), 197–212, 1987).

Les différences les plus évidentes sont les suivantes :

- L'industrie nucléaire est hautement spécialisée tandis que l'industrie chimique est extrêmement diverse.

- L'industrie nucléaire est considérablement plus petite que l'industrie chimique.

- L'industrie nucléaire a pour matières premières quelques composés bien précis qu'on peut suivre à la trace tandis que l'industrie chimique utilise des approvisionnements et des matières plus nombreux, plus complexes et moins facilement repérables.

- Les garanties nucléaires ne sont pas uniformément imposées à tous les États membres ni à toutes les installations. Dans une CAC, la protection des intérêts des États plus faibles serait une considération majeure.

- L'AEIA est à la fois un organisme de protection et un fournisseur d'information, mais on peut s'interroger sur l'opportunité que l'OIAC assume ce deuxième rôle.

- Bien que l'AIEA puisse être fière de ses réalisations en matière de garanties, il existe des moyens autres que les détournements pour produire des explosifs nucléaires. Si l'on établit un parallèle avec la CAC, on pourrait penser à un contrôle serré exercé sur les entreprises chimiques qui ne toucherait en rien les installations de production d'armes. Ce n'est sûrement *pas* là l'objet de la CAC.

Ainsi, les opérations de garanties de l'AIEA ne peuvent servir que de point de départ, comme étude de cas, à un cadre conceptuel très général.

Il a été signalé que les conditions techniques et commerciales de l'industrie chimique pouvaient rendre inutiles bien des méthodes particulières utilisées aujourd'hui par l'AIEA. Il importera de reconnaître ce fait et de ne pas se contenter de copier les façons de procéder de l'AIEA. Selon certains participants, l'AIEA a sous-estimé les problèmes technologiques avec lesquels elle était aux prises et surestimé les possibilités techniques disponibles. Par ailleurs, il faudra une somme considérable de recherches préparatoires sur les approches techniques de la vérification des armes chimiques avant qu'une CAC puisse être conclue. On a rappelé en outre les problèmes que posent les listes de produits chimiques faisant l'objet d'un contrôle, non seulement parce que ces listes peuvent rapidement devenir périmées mais également parce que les méthodes d'analyse ne sont pas mises au point ni possibles dans certains cas.

En ce qui a trait à l'adoption de nouvelles technologies de vérification, les exigences immédiates ont tendance, a-t-on fait remarquer, à l'emporter sur les besoins à long terme. En outre, le système doit pouvoir être compris au niveau politique. Les États voudront savoir comment est dépensé l'argent qu'ils consacrent à la recherche-développement en matière de vérification, quels résultats ont été obtenus, quelle information est nécessaire, etc. La crédibilité politique d'un système technique est donc un facteur qu'il faut reconnaître, au dire des participants. Il importe de se donner une certaine marge de manœuvre dans l'adoption des nouvelles technologies : il serait prudent de ne pas être trop spécifique relativement à la technologie à utiliser pour la vérification, car l'industrie à vérifier pourrait bien évoluer beaucoup plus rapidement que les instruments et les méthodes utilisés par les inspecteurs.

Les problèmes de contrôle de l'information, selon certains intervenants, ne touchent pas uniquement les droits de propriété mais également divers aspects de la sécurité. On a fait remarquer que le processus d'inspection lui-même pouvait être à la source de fuites d'information. Toutefois, comme certains l'ont affirmé, les craintes initiales concernant l'information protégée par des droits de propriété se sont révélées beaucoup plus fondées en théorie qu'en pratique dans le cadre du TNP, mais il reste que la protection du caractère confidentiel pourrait poser un problème plus grave dans la mise en œuvre d'une CAC. Quelle information doit être fournie au corps exécutif de l'Agence? Les déclarations doivent-elles être publiques ou de diffusion restreinte? Dans ce dernier cas, qui en seraient les destinataires? De quelle information ont besoin les parties intéressées pour qu'elles soient satisfaites? On a fait observer que le conseil de l'AIEA n'était pas mis au courant des accords subsidiaires relatifs à des installations et qu'il serait peut-être souhaitable de conserver ces accords confidentiels pour empêcher les États d'exercer des pressions pour maintenir

les contrôles au niveau le plus bas. En ce qui a trait au caractère délicat de l'information commerciale, certains ont avancé que la protection de cette information deviendrait moins prioritaire une fois que, au-delà des données sur les usines individuelles, l'information serait traitée et condensée à un niveau supérieur.

En conclusion, l'atelier s'est déroulé d'une manière qui a permis des discussions franches et un libre échange d'idées, sans qu'on ait eu l'intention de conclure la session par des résolutions, des déclarations définitives ou des recommandations bien précises. Comme M^me^ Critchley l'a signalé dans son discours de clôture, les discussions ont très souvent porté sur des questions techniques qui, comme les faits l'ont démontré, ne semblaient pas avoir grand-chose en commun avec l'expérience de l'AIEA. L'examen des questions politiques et organisationnelles, en revanche, gagnerait à se faire davantage à la lumière de l'expérience de l'AIEA, ce qui n'a pu être réalisé au cours de l'atelier, faute de temps.

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